AD-742 000

EMBRITTLEMENT

A DDC BIBLIOGRAPHY

DDC-TAS-72-21-I

MAY 1972

DEFENSE DOCUMENTATION CENTER
DEFENSE SUPPLY AGENCY

UNCLASSIFIED

Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author)
DEFENSE DOCUMENTATION CENTER
Cameron Station
Alexandria, Virginia 22314

2a. REPORT SECURITY CLASSIFICATION
UNCLASSIFIED

2b. GROUP

3. REPORT TITLE
EMBRITTLEMENT

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)
Bibliography (March 1963 - September 1971)

5. AUTHOR(S) (First name, middle initial, last name)

6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
May 1972	142	100

8a. CONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S)
b. PROJECT NO.	DDC-TAS-72-21-I
c.	9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)
d.	AD-742 000

10. DISTRIBUTION STATEMENT
Approved for public release; distribution unlimited.

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY
Supersedes AD-708 700	

13. ABSTRACT

References in this bibliography cover such topics as: embrittlement of metals by organic liquids, embrittlement of high strength steel and aluminum in the presence of water, alcohols, glycols, ethers, and aldehydes, embrittlement of polycrystalline silver chloride, investigation of thermal embrittlement in managing steel, liquid metal embrittlement, stress-relief embrittlement of HY-130(T) weld metals and effect of embrittled 110-18 weld metal on the fatigue life of HY-80 steel butt weldments, etc.

Corporate Author-Monitoring Agency, Subject, Title, Contract, and Report Number Indexes are included.

DD FORM 1 NOV 1473

UNCLASSIFIED

Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
*Bibliographies						
*Embrittlement						
Steel Embrittlement						
Titanium Alloys						
Brass						
Metals						
Steel						
Radiation Damage						
Maraging Steels						
Reactor Materials						
Crystals						
Copper Alloys						
Liquid Metals						
Zinc Alloys						
Aluminum Alloys						
Pressure Vessels						
Lead Alloys						
Chromium Alloys						
Complex-ion Embrittlement						
Stress Corrosion						
Fracture(Mechanics)						
Plating						
Heat Treatment						
Corrosion						
Hydrogen Embrittlement						
Ductility						
Weldability						
Plastics						
Nuclear Reactors						
Vanadium						
Welds						
Composite Propellants						

AD-742 000

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A DDC BIBLIOGRAPHY

DDC-TAS-72-21-1

March 1963 - September 1971

MAY 1972

DEFENSE DOCUMENTATION CENTER
DEFENSE SUPPLY AGENCY
CAMERON STATION
ALEXANDRIA, VIRGINIA 22314

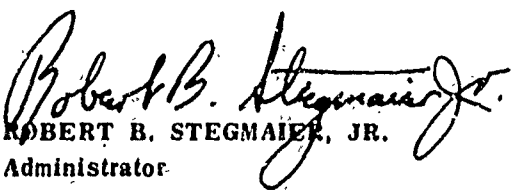
F O R E W O R D

This bibliography is a compilation of references on *Embrittlement*. Entries were selected from reports processed into the AD data bank from January 1953 to February 1972, and it revises and updates an earlier bibliography, AD-708 700, on the same subject.

Computer-generated indexes for Corporate Author-Monitoring Agency, Subject, Title, Contract Number, and Report Number are included.

BY ORDER OF THE DIRECTOR, DEFENSE SUPPLY AGENCY

OFFICIAL



ROBERT B. STEGMAIER, JR.
Administrator
Defense Documentation Center

C O N T E N T S

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1Z8ML1

AD-426 464
IIT RESEARCH INST CHICAGO ILL

EMBRITTLEMENT OF METALS BY ORGANIC LIQUIDS. (U)

DESCRIPTIVE NOTE: SUMMARY REPT., 1 DEC 62-30 NOV 63.
JAN 64 37P
REPT. NO. IITRI B183B2 4
CONTRACT: DA11 022ORD3108

UNCLASSIFIED REPORT

DESCRIPTORS: (*ALUMINUM, BRITTLENESS), (*STEEL, BRITTLENESS), (*BRITTLENESS, METALS), (*ORGANIC COMPOUNDS, BRITTLENESS), TENSILE PROPERTIES, FATIGUE (MECHANICS), FAILURE (MECHANICS), FRACTURE (MECHANICS), WATER, ETHERS, ALCOHOLS, ALDEHYDES, SOLUTIONS. (U)
IDENTIFIERS: 1964, EMBRITTLEMENT. (U)

HIGH-STRENGTH STEEL AND ALUMINUM ARE SHOWN TO BE EMBRITTLED IN NOTCHED FATIGUE TESTING IN THE PRESENCE OF WATER, ALCOHOLS, GLYCOLS, ETHERS, AND ALDEHYDES. IT IS SHOWN THAT LONGER CARBON CHAINS, BRANCHING MOLECULAR SHAPES, AND CLOSED RINGS REDUCE THE DEGREE OF EMBRITTLEMENT WHILE MULTIPLICITY OF (-OH) OR (-O-) GROUPS ENHANCE IT. BY A VARIETY OF EXPERIMENTS AND DEDUCTIONS, WATER IS SHOWN TO BEHAVE MORE LIKE A ZERO CHAIN LENGTH ORGANIC MOLECULE RATHER THAN AN ELECTRO LYTIC MEDIUM. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY - SEARCH CONTROL NO. 1ZBML1

AD-444 017
FRANKFORD ARSENAL PHILADELPHIA PA PITMAN-DUNN RESEARCH LABS

THE EFFECT OF EXPOSURE TIME ON THE EMBRITTLEMENT OF CU-2 PERCENT BE ALLOY BY LIQUID AMALGAM, (U)

JUN 64 8P RINNOVATORE,J. V. ;CORRIE,J. D. ;MARKUS,H. ;
PROJ: 1A 0 1U501B010
MONITOR: PDLG A64 8

UNCLASSIFIED REPORT
REPRINT FROM ASM TRANSACTIONS QUARTERLY, 57:2,PP. 474-481, JUNE 1964. (COPIES NOT SUPPLIED BYDDC).
SUPPLEMENTARY NOTE:

DESCRIPTORS: (*LIQUID METALS, MERCURY ALLOYS), (*COPPER ALLOYS, BRITTLENESS), SODIUM ALLOYS, STRAIN (MECHANICS), BERYLLIUM ALLOYS, FRACTURE (MECHANICS), AGING (MATERIALS), GRAIN BOUNDARIES (U)
IDENTIFIERS: EMBRITTLEMENT, COPPER ALLOY 2BE, WETTING (U)

THE EMBRITTLEMENT OF CU-2% BE AS A FUNCTION OF TIME OF EXPOSURE TO A HG-2% NA AMALGAM HAS BEEN STUDIED. IT IS SHOWN THAT TIME OF EXPOSURE TO LIQUID AMALGAM HAS A PRONOUNCED EFFECT ON THE DEGREE OF EMBRITTLEMENT INDUCED IN THE ALLOY. THE EFFECT IS EVIDENCED BY A DECREASE IN WETTED FRACTURE STRENGTH AND BY GRAIN BOUNDARY PENETRATION OF THE ALLOY BY THE AMALGAM. THIS OCCURS IN BOTH THE AGED AND AGED PLUS COLD WORKED CONDITIONS, BUT TO A GREATER DEGREE IN THE LATTER CONDITION. IT IS SHOWN ALSO THAT PENETRATION IN THE FORM OF GRAIN BOUNDARY GROOVING DOES NOT PRODUCE A DETRIMENTAL EFFECT IN ITSELF. EMBRITTLEMENT DOES NOT OCCUR IF THE AMALGAM IS REMOVED REGARDLESS OF THE PAST HISTORY OF WETTING. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 12BML1

AD-489 216 11/6
GENERAL ELECTRIC CO PHILADELPHIA PA MISSILE AND SPACE DIV

DEVELOPMENT OF COMPOSITE STRUCTURAL MATERIALS FOR HIGH TEMPERATURE APPLICATIONS. (U)

DESCRIPTIVE NOTE: QUARTERLY REPT. NO. 2, 23 FEB-22 MAY 66,
MAY 66 53P CHORNE,J. ;BRUCH,C. ;
SUTTON,W. H. ;
CONTRACT: NOW-66-0443

UNCLASSIFIED REPORT

DESCRIPTORS: (*COMPOSITE MATERIALS, *HEAT-RESISTANT METALS + ALLOYS), (*ALUMINUM, *SINGLE CRYSTALS), CRYSTAL GROWTH, WHISKERS(CRYSTALS), TEMPERATURE, TENSILE PROPERTIES, DUCTILITY, ELECTROPLATING, EMBRITTLEMENT, BONDING, OXIDES, REINFORCING MATERIALS, FILAMENTS, NICKEL, FEASIBILITY STUDIES, CRYSTAL LATTICE DEFECTS, HEAT TREATMENT (U)

THE PURPOSE OF THIS PROGRAM IS THE DEVELOPMENT OF NEW STRUCTURAL COMPOSITE MATERIALS WITH HIGH STRENGTH-TO-WEIGHT RATIOS AT ELEVATED TEMPERATURES. THE CURRENT EFFORT IS BEING DIRECTED TOWARDS THE REINFORCEMENT OF NICKEL BY USING ULTRA-HIGH STRENGTH AL2O3 SINGLE CRYSTAL WHISKERS. THE MAJOR EMPHASIS WAS PLACED ON THE FABRICATION AND TESTING OF EXPERIMENTAL NI-AL2O3 WHISKER COMPOSITES PREPARED BY ELECTRODEPOSITION AND PRESSURE BONDING TECHNIQUES. SUBSTANTIAL PROGRESS WAS MADE IN THE WHISKER GROWTH AREA. EXPERIMENTS UTILIZING AN AIR ELUTRIATION TECHNIQUE HAVE DEMONSTRATED GOOD POTENTIAL FOR BENEFICIATING, CLASSIFYING AND ORIENTING THE TYPE OF ALUMINA WHISKERS GROWN AT THIS LABORATORY. STUDIES OF ELECTROPLATED NICKEL SHOW THAT IT IS SUBJECT TO EMBRITTLEMENT WHEN HEATED TO THE TEMPERATURE RANGE OF 800 TO 1000 C. ELECTRO FORMED BUNDLES OF WHISKERS WERE PRESSURE BONDED AT HIGHER TEMPERATURES THAN PREVIOUSLY USED. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-600 932
UNITED STATES STEEL CORP MONROEVILLE PA

THE EFFECT OF SPECIAL ADDITIONS ON THE NOTCH TOUGHNESS OF MARAGING STEELS. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.
APR 64 25P BIRKLE,A. J. ;DABKOWSKI,D. S. ;PORTER,L. F. ;
CONTRACT: NOBS88540
PROJ: SS050 000
TASK: 1507

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*MARAGING STEELS, TOUGHNESS), (*BORON, METALLURGY), (*ZIRCONIUM, METALLURGY), (*STEEL, MECHANICAL PROPERTIES), NICKEL, CHROMIUM, MOLYBDENUM, COBALT, GRAIN BOUNDARIES, HEAT TREATMENT, CHEMICAL PROPERTIES, MELTING (U)
IDENTIFIERS: STEEL HY-180/210, NOTCH TOUGHNESS, ANNEALING, EMBRITTLEMENT (U)

THE RESULTS INDICATED THAT WHEN LABORATORY AIR-MELTED OR VACUUM-MELTED HEATS OF 12NI-3CR-3MO, 12NI-5CR-3MO, OR 18NI-8CO-3MO MARAGING STEELS CONTAINED ABOUT 0.02 PERCENT ZIRCONIUM, THEIR NOTCH TOUGHNESS IN THE SOLUTION-ANNEALED AND IN THE SOLUTION-ANNEALED AND AGED CONDITIONS WAS MARKEDLY LOWER THAN THAT OF THE SAME STEELS CONTAINING NO BORON OR ZIRCONIUM OR CONTAINING ONLY BORON. THE RESULTS ALSO INDICATED THAT THE STEELS CONTAINING BORON WERE SLIGHTLY MORE NOTCH TOUGH THAN THE STEELS CONTAINING NO BORON OR ZIRCONIUM, AND THAT THE STEELS CONTAINING ABOUT 0.005 PERCENT CARBON WERE MORE NOTCH TOUGH THAN THE STEELS CONTAINING ABOUT 0.017 PERCENT CARBON. IN ADDITION, THERE WAS SOME INDICATION THAT THE ELIMINATION OF ALUMINUM MAY ALSO SIGNIFICANTLY IMPROVE NOTCH TOUGHNESS. ON THE BASIS OF THE ABOVE RESULTS, LABORATORY AND PRODUCTION HEATS OF MARAGING STEELS HAVING YIELD STRENGTHS IN THE RANGE 180 TO 210 KSI ARE NOW BEING MELTED WITHOUT THE SPECIAL ZIRCONIUM ADDITION. ADDITIONAL LABORATORY STUDIES ARE NOW IN PROGRESS TO DETERMINE THE OPTIMUM TITANIUM AND ALUMINUM CONTENT FOR MARAGING STEELS HAVING YIELD STRENGTHS IN THE RANGE 180 TO 210 KSI, AFTER WHICH THE EFFECT OF NICKEL, CHROMIUM, COBALT, AND MOLYBDENUM WILL BE INVESTIGATED WITH THE AIM OF DEVELOPING THE OPTIMUM OVER-ALL COMPOSITION FOR THESE TYPES OF MARAGING. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-630 420 11/6
FRANKFORD ARSENAL PHILADELPHIA PA QUALITY ASSURANCE DIRECTORATE

RELATIONSHIP BETWEEN EMBRITTLEMENT BEHAVIOR AND INTERFACIAL ENERGIES FOR COPPER WETTED WITH BINARY BISMUTH-THALLIUM LIQUID METAL ALLOYS AT 650 F. (U)

FEB 66 30P ROGUS,BERNARD J. ;
MONITOR: FA ; R-1800

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*COPPER, EMBRITTLEMENT), (*LIQUID METALS, COMPATIBILITY), (*BISMUTH ALLOYS, THALLIUM ALLOYS), SURFACE PROPERTIES, SURFACE-ACTIVE SUBSTANCES, TEMPERATURE, FRACTURE(MECHANICS) (U)

EMBRITTLEMENT BEHAVIOR OF COPPER WAS STUDIED IN TERMS OF INTERFACIAL ENERGIES BETWEEN THE SOLID COPPER AND BINARY BISMUTH-THALLIUM LIQUID METAL COMPOSITIONS. WETTED FRACTURE STRENGTH DETERMINATIONS WERE MADE ON COPPER TENSILE SPECIMENS WHICH WERE IN CONTACT WITH THE LIQUID METAL ALLOYS AT 650 F. TESTS WERE MADE AS THE RELATIVE PROPORTIONS OF BISMUTH AND THALLIUM IN THE LIQUID WETTING METAL WERE VARIED. IT WAS FOUND THAT THE EMBRITTLING EFFECT OF BISMUTH ON COPPER DECREASES AS THE THALLIUM CONTENT OF THE WETTING BISMUTH-THALLIUM ALLOY IS INCREASED. THIS TREND TO HIGHER STRENGTH VALUES WAS CORRELATED WITH THE CORRESPONDING INCREASE IN INTERFACIAL ENERGIES FOR THE COPPER-BISMUTH-THALLIUM SYSTEM. THE EMBRITTLEMENT OF SOLID COPPER MAY BE RELATED TO REDUCTIONS IN SURFACE ENERGY REQUIREMENTS NEEDED FOR CRACK PROPAGATION AS A RESULT OF THE PRESENCE OF THE LIQUID METAL. HOWEVER, DEVIATIONS NOTED IN THE RELATIONSHIP BETWEEN WETTED FRACTURE STRENGTH VALUES AND INTERFACIAL ENERGIES SUGGEST THAT EMBRITTLEMENT BEHAVIOR CANNOT BE EXPLAINED FULLY ON THE BASIS OF INTERFACIAL ENERGIES ALONE. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-632 074 11/6 13/8 13/10
NAVY MARINE ENGINEERING LAB ANNAPOLIS MD

PROPERTIES OF THE WELD HEAT-AFFECTED ZONE IN HY-130/150 STEEL. (U)

DESCRIPTIVE NOTE: RESEARCH AND DEVELOPMENT PHASE REPT.,
APR 66 15P HOLSBERG,P. W. ;SCHREITZ,W. G. ;
REPT. NO. MEL-87/66,
PROJ: S-F020-01-05,
TASK: 0728,

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*STEEL, *WELDABILITY), (*METALLOGRAPHY, STEEL), (*EMBRITTLEMENT, STEEL), IRON ALLOYS, NICKEL ALLOYS, CHROMIUM ALLOYS, MOLYBDENUM ALLOYS, VANADIUM ALLOYS, SHIP PLATES, HIGH-TEMPERATURE RESEARCH, WELDING, THERMAL STRESSES, STRESS RELIEVING, IMPACT TESTS, MARINE ENGINEERING, SIMULATION, WELDS (U)
IDENTIFIERS: STEEL HY-130/150 (U)

PROPERTIES OF THE WELD HEAT-AFFECTED ZONE, INCLUDING HOT-CRACKING TENDENCIES AND EFFECTS OF THERMAL CYCLING ON STRENGTH AND TOUGHNESS, WERE DETERMINED FOR A 5NI-CR-MO-V STEEL DEVELOPED AS AN HY-130/150 HULL PLATE ALLOY. THE HOT-CRACKING TENDENCY OF THE ALLOY WAS LOW. THE YIELD STRENGTH OF THE HEAT-AFFECTED ZONE WAS EQUIVALENT TO THAT OF THE BASE METAL. THE CHARPY V-NOTCH IMPACT STRENGTH OF SAMPLES WHICH HAD RECEIVED DOUBLE THERMAL CYCLES, SIMULATING MULTIPASS WELDMENTS, WAS EQUIVALENT TO THAT OF THE BASEPLATE IN BOTH THE AS-WELDED AND THE STRESS-RELIEVED CONDITIONS. THESE RESULTS, OBTAINED BY WELD-SIMULATION METHODS, WERE CONFIRMED BY IMPACT TESTS OF SAMPLES FROM THE HEAT-AFFECTED ZONE OF ACTUAL WELDMENTS. THE IMPACT STRENGTH OF THE AS-DEPOSITED WELD METAL WAS LOW COMPARED TO THE BASEPLATE AND WAS GREATLY REDUCED BY STRESS-RELIEF TREATMENT. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-633 018 20/4 11/6
FRANKLIN INST RESEARCH LABS PHILADELPHIA PA

LIQUID METAL EMBRITTLEMENT. PHASE III. A STUDY OF THE EFFECT OF LIQUID MERCURY ON SLIP ACTIVITY IN NEAR-SURFACE REGIONS OF ALPHA-BRASS SINGLE CRYSTALS. (U)

DESCRIPTIVE NOTE: FINAL TECHNICAL REPT., 1 SEP 65-31 MAR 66,
APR 66 32P ORAVA,R. N. ;
REPT. NO. F-B2119-2,
CONTRACT: NONR-4225(00),
PROJ: NR-036-056,

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: PHASE 3 OF STUDY OF THE PHENOMENON OF METAL EMBRITTLEMENT.

DESCRIPTORS: (*EMBRITTLEMENT, *LIQUID METALS), (*DEFORMATION, CRYSTAL LATTICE DEFECTS), BRASS, MERCURY, ETCHED CRYSTALS, SINGLE CRYSTALS, FRACTURE(MECHANICS), PLASTICITY (U)

MICROSTRAIN AND ETCHING EXPERIMENTS WERE CONDUCTED ON 70/30 BRASS SINGLE CRYSTALS TO DETERMINE THE EFFECT OF THE PRESENCE OF LIQUID MERCURY AT THE SURFACE ON DEFORMATION CHARACTERISTICS IN THE EARLY STAGES OF PLASTIC FLOW. IT WAS REVEALED THAT DISLOCATIONS BECOME MOBILE AT STRESSES AS LOW AS 0.04 Kg.MM- TO THE -2 IN ANNEALED CRYSTALS, A SHARP CONTRAST TO PREVIOUS OBSERVATIONS. A MODEL IS PRESENTED TO EXPLAIN THE MICROSTRAIN CHARACTERISTICS. A DEBRIS LAYER NEAR THE SURFACE WAS OBSERVED TO A DEPTH OF ABOUT 20 MICRONS AFTER 2 X 10 TO THE -3 PLASTIC SHEAR STRAIN, IRRESPECTIVE OF THE PRESENCE OF MERCURY. THUS, LIQUID MERCURY IS EQUALLY AS EFFECTIVE AS AN OXIDE FILM IN IMPEDING THE EMERGENCE OF DISLOCATIONS FROM A CRYSTAL. SINCE THE DEGREE TO WHICH THIS TYPE OF BEHAVIOR INHIBITS CRACK RELAXATION COULD NOT BE DETERMINED, IT WAS NOT POSSIBLE TO RIGOROUSLY ESTABLISH THIS AS THE MECHANISM FOR LIQUID METAL EMBRITTLEMENT. (AUTHOR) (U)

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DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-635 844 18/10 18/8 11/6
NAVAL RESEARCH LAB WASHINGTON D C

IRRADIATION EFFECTS ON REACTOR STRUCTURAL MATERIALS ! FEBRUARY - 30 APRIL 1966. (U)

DESCRIPTIVE NOTE: QUARTERLY PROGRESS REPT.
MAY 66 63P STEELE ,LENDELL E. ; HAWTHORNE ,RUSSELL J. ;SERPAN,CHARLES Z. , JR.;
REPT. NO. NRL-MR-1700,
CONTRACT: AT(49-5)-2110.
PROJ: RRU07-01-46-5409,SF020-01-05-0858

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO AD-630 932.

DESCRIPTORS: (*REACTOR MATERIALS, STEEL), (*STEEL, RADIATION DAMAGE), (*RADIATION DAMAGE, REACTOR MATERIALS), NICKEL ALLOYS, EMBRITTLEMENT, DUCTILITY, CHROMIUM ALLOYS, MOLYBDENUM ALLOYS, STRESS RELIEVING, SENSITIVITY, MICROSTRUCTURE, STAINLESS STEEL, NOTCH SENSITIVITY, HEAT TREATMENT, TRANSITION TEMPERATURE, NEUTRONS (U)
IDENTIFIERS: STEEL A302-B (U)

THE INVESTIGATION INCLUDES THE FOLLOWING: (1) THE RELATIVE RADIATION SENSITIVITY OF A302-B STEELS PREPARED BY SPECIAL MELTING AND HEAT TREATMENT PRACTICE, (2) THE EVALUATION OF NICKEL CONTENT AS A RADIATION SENSITIVITY VARIABLE, (3) COMPARATIVE IRRADIATION ENBRITTLEMENT OF SELECTED HIGHER STRENGTH STEELS, AND (4) THE EFFECT OF NEUTRON SPECTRA UPON THE OBSERVED CHANGES IN THE NOTCH DUCTILITY OF IRRADIATED STEELS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-637 693 11/6 20/11
AEROSPACE TECHNOLOGY DIV LIBRARY OF CONGRESS WASHINGTON D C

LIQUID-METAL EMBRITTLEMENT: ANNOTATED BIBLIOGRAPHY. (U)

DESCRIPTIVE NOTE: REPT. NO. 1 ON ATD WORK ASSIGNMENT NO. 89/6.
APR 66 25P
REPT. NO. ATD-66-38,
MONITOR: TT 66-62135

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*LIQUID METALS, *EMBRITTLEMENT), METALLOGRAPHY, COPPER ALLOYS, STEEL, CORROSION, MECHANICAL PROPERTIES, ZINC, MERCURY, CRYSTALLOGRAPHY, BIBLIOGRAPHIES, USSR (U)

THE BIBLIOGRAPHY WAS COMPILED FROM SOVIET OPEN SOURCES PUBLISHED 1959-1965 WITH ONE ENTRY FROM JANUARY 1966. IT IS THE FIRST REPORT IN THIS SERIES. THE 52 ENTRIES ARE ARRANGED CHRONOLOGICALLY AND, WITHIN EACH YEAR, ALPHABETICALLY BY AUTHOR: 1959 (1 ENTRY), 1961 (6 ENTRIES), 1963 (21 ENTRIES), 1964 (3 ENTRIES), 1965 (14 ENTRIES), AND 1966 (1 ENTRY). AN AUTHOR INDEX IS PROVIDED AT THE END OF THE REPORT. PERTINENT INFORMATION INCLUDED: COPPER ALLOY TESTING IN MERCURY SALT SOLUTION, CREEP PROCESS, DIFFUSION AND SOLUBILITY COEFFICIENTS OF MOLTEN METALS, POLYCRYSTALLINE METAL, TIN RECRYSTALLIZATION, ALLOY STEEL NONSELECTIVE CORROSION, SURFACE TENSION REDUCTION IN SOLID METALS, SOFTENING ACTION OF AGGRESSIVE MELTS ON SOLID METAL, STEEL CYCLIC TORSION IN LOW-MELTING METALS, ADSORPTION-INDUCED REDUCTION OF STRENGTH, IRRADIATION EFFECT ON MECHANICAL PROPERTIES, ANISOTROPY OF ELECTRON AND GAMMA IRRADIATION EFFECT ON DEFORMATION PROCESS, METAL CORROSION FATIGUE, EFFECT OF LOW MELTING COATING ON MECHANICAL PROPERTIES OF METALS, METAL DIFFUSION IN LIQUID COPPER. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-639 481 11/6
STANFORD RESEARCH INST MENLO PARK CALIF

EMBRITTLEMENT BY LIQUID METALS. (U)

DESCRIPTIVE NOTE: FINAL REPT., 1 MAR 64-28 FEB 66,
FEB 66 10P GOGGIN,W. R. ;MOBERLY,J. W. ;
CONTRACT: NONR-4408(00)
PROJ: NR-036-058,

UNCLASSIFIED REPORT
AVAILABILITY: PUBLISHED IN TRANSACTIONS QUARTERLY V59 N2 P315-23 JUN 2 1966.
SUPPLEMENTARY NOTE:

DESCRIPTORS: (*ALUMINUM, EMBRITTLEMENT), (*EMBRITTLEMENT, LIQUID METALS), GALLIUM, FOILS, FRACTURE(MECHANICS), SINGLE CRYSTALS, ELECTRON MICROSCOPY (U)

THE ALUMINUM-LIQUID GALLIUM EMBRITTLEMENT COUPLE WAS STUDIED USING TECHNIQUES OF TRANSMISSION ELECTRON MICROSCOPY. SINGLE AND POLYCRYSTALLINE ALUMINUM FOILS WERE WETTED WITH LIQUID GALLIUM AND TESTED USING A TENSILE DEVICE IN AN ELECTRON MICROSCOPE. THE INFLUENCE OF THE LIQUID GALLIUM ON THE FRACTURE BEHAVIOR OF ALUMINUM WAS OBSERVED. POLYCRYSTALLINE ALUMINUM CAN FAIL WHEN WETTED WITH LIQUID GALLIUM BY A GRAIN BOUNDARY PENETRATION OF THE METAL BY THE LIQUID. THIS IS A SLOW-FAILURE PROCESS AND IS OBSERVED TO OCCUR WITH OR WITHOUT EXTERNAL LOADING, IN BOTH ANNEALED AND COLD WORKED ALUMINUM. HOWEVER, IF SUFFICIENT TENSILE STRESSES ARE APPLIED, POLYCRYSTALLINE ALUMINUM CAN ALSO FAIL IN A CACTCCRUPHIC MANNER WITH A HIGH CRACKING VELOCITY ALONG INTERGRANULAR PATHS. LIQUID GALLIUM IS NECESSARY FOR BUTH CRACK NUCLEATION AND PROPAGATION. THE CRACK WAS ALWAYS OBSERVED TO INITIATE IN REGIONS WHERE GRAIN BOUNDARY PENETRATION OF THE ALUMINUM HAD OCCURRED. THIN LAYERS OF LIQUID METAL WERE ALWAYS DETECTED ALONG THE FRESH FRACTURE SURFACE. IF INSUFFICIENT GALLIUM WAS PRESENT, THE CRACK WOULD BECOME BLUNTED AND THE METAL WOULD EVENTUALLY EXPERIENCE DUCTILE FAILURE, CHARACTERISTIC OF UNWETTED ALUMINUM. ALUMINUM SINGLE CRYSTALS NEARLY ALWAYS FAIL IN A DUCTILE MANNER, EVEN WHEN AN ABUNDANT SUPPLY OF LIQUID GALLIUM IS AVAILABLE. THE LIQUID GALLIUM CAN INITIATE MICROCRACKS IN SINGLE-CRYSTAL ALUMINUM, BUT THE CRACKS DO NOT PROPAGATE IN THE BRITTLE MANNER OBSERVED IN POLYCRYSTALLINE ALUMINUM. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1Z8ML1

AD-639 567 11/6 14/4 13/10
PACIFIC NAVAL LAB ESQUIMALT (BRITISH COLUMBIA)

RELIABILITY AND CORROSION. (U)

66 12P BAREN,R. D. ;
REPT. NO. REPRINT-66-2,

UNCLASSIFIED REPORT
AVAILABILITY: PUBLISHED IN NAVAL ENGINEERS JOURNAL P321-331 APR 1966.
SUPPLEMENTARY NOTE:

DESCRIPTORS: (*CORROSION, RELIABILITY), ALUMINUM ALLOYS, CASTING ALLOYS, STRESS CORROSION, PIPES, EMBRITTLEMENT, CATHODIC PROTECTION, STAINLESS STEEL, BRASS, FATIGUE(MECHANICS), MARINE ENGINEERING, CANADA, CORROSION INHIBITION (U)

THE EXAMPLES GIVEN AND DISCUSSED ARE FAR FROM AN EXHAUSTIVE TREATMENT OF HAZARDS BETWEEN DESIGN OFFICE AND FIELD EXECUTION, OF THE NEED FOR ATTENTION TO DETAIL AND OF THE WEAKNESSES INHERENT IN SOME ALLOYS, OF THE IMPORTANCE OF CORRECT DIAGNOSIS AND FINALLY, THAT IN SOME CASES RELIABILITY CAN BE RESTORED. RELIABILITY IS NOT SIMPLE-IT REQUIRES AN ATTENTION TO DETAIL IN CHOICE OF MATERIAL AND IN DESIGN. IT DEMANDS AN UNDERSTANDING OF CORROSION MECHANISMS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-639 668 11/9
ILLINOIS UNIV URBANA DEPT OF THEORETICAL AND APPLIED MECHANICS

MECHANISMS OF ENVIRONMENT INDUCED SUBCRITICAL FLAW GROWTH IN AISI 4340 STEEL. (U)

DESCRIPTIVE NOTE: INTERIM TECHNICAL REPT.,
SEP 66 47P VAN DER SLUYS,WILLIAM A. N
;
REPT. NO. T/AM-292,
CONTRACT: DA-31-124-ARO(D)-378,
PROJ: DA-20014501B320,
MONITOR: AROD 5612:1

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*STEEL, *FRACTURE(MECHANICS)), HYDROGEN EMBRITTLEMENT, CORROSION, EMBRITTLEMENT, ENVIRONMENTAL TESTS, STRESS CORROSION, LIQUID IMMERSION TESTS, WATER (U)
IDENTIFIERS: STEEL 4340 (U)

RESULTS OF AN EXPERIMENT DESIGNED TO STUDY THE EFFECT OF SEVERAL VARIABLES ON SUBCRITICAL CRACK GROWTH RATE OF A HIGH-STRENGTH STEEL IN A WATER ENVIRONMENT ARE PRESENTED. ENVIRONMENTAL VARIABLES INCLUDED TEMPERATURE, pH OF THE LIQUID ENVIRONMENT, ELECTRIC CHARGING, AND THE COMBINED EFFECT OF PH AND ELECTRIC CHARGING. TAPERED DOUBLE CANTILEVER BEAM SPECIMENS WERE DESIGNED SO THAT THE LEVEL WAS MAINTAINED CONSTANT AT A CONSTANT LOAD AND INDEPENDENT OF CRACK LENGTH. THUS STEADY-STATE CRACK GROWTH MEASUREMENTS WERE POSSIBLE IN CONSTANT LOAD AND CONSTANT ENVIRONMENT EXPERIMENTS. WITH THIS SPECIMEN DESIGN, IT WAS POSSIBLE TO MAKE A SERIES OF MEASUREMENTS THAT COVERED THE ENTIRE RANGE OF EFFECTS OF A PARTICULAR VARIABLE USING ONLY ONE SPECIMEN. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-639 748 18/8 18/10 11/6
NAVAL RESEARCH LAB WASHINGTON D C

DAMAGING NEUTRON EXPOSURE CRITERIA FOR EVALUATING THE EMBRITTLEMENT OF REACTOR PRESSURE VESSEL STEELS IN DIFFERENT NEUTRON SPECTRA. (U)

DESCRIPTIVE NOTE: INTERIM REPT.,
JUL 66 31P SERPAN,CHARLES Z. , JR. ;
STEELE,LENDELL E. ;
REPT. NO. NRL-6415,
CONTRACT: AT(49-5)-2110,
PROJ: RR007-01-46-5409,SF020-01-25-0858

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (•STEEL, •RADIATION DAMAGE), EMBRITTLEMENT, PRESSURE VESSELS, REACTOR MATERIALS, NEUTRON FLUX, NUCLEAR REACTORS, DETERMINATION, TRANSITION TEMPERATURE (U)

SEVERAL SUCH EXPOSURE CRITERIA HAVE BEEN EVALUATED THROUGH USE OF THE RESULTS OF METALLURGICAL TESTS OF REFERENCE STEEL SPECIMENS AFTER IRRADIATION IN LIGHT AND HEAVY WATER MODERATED REACTOR ENVIRONMENTS AS WELL AS IN GRAPHITE MODERATED REACTOR ENVIRONMENTS. THE RADIATION-INDUCED TRANSITION TEMPERATURE OR NIL-DUCTILITY TRANSITION (NDT) TEMPERATURE INCREASES OF THE SEVERAL STEELS INVOLVED ARE PRESENTED VERSUS N/CM2 DETERMINED BY EACH OF THE FOLLOWING TECHNIQUES: (A) ASSUMPTION OF A FISSION SPECTRUM, EXTRAPOLATION OF ACTIVATION DATA INDUCED AT A HIGH MEV THRESHOLD TO 1 MEV, AND REPORTING EXPOSURE > 1 MEV, AND (B) CALCULATION OF SPECTRA USED TO DETERMINE ACTIVATION CROSS SECTION FOR EXPOSURES ABOVE ENERGY LIMITS OF 1, 0.5, AND 0.183 MEV. THE DIFFERENCES OBSERVED BY THIS ANALYSIS WERE INTERCOMPARED IN RELATION TO ABSOLUTE MAGNITUDE AS WELL AS IN TERMS OF ENGINEERING SIGNIFICANCE. BY APPLYING THESE CRITERIA TO DATA RELATING DIRECTLY TO A PRESSURIZED LIGHT WATER POWER REACTOR, BENEFITS TO THE LIFETIME OF THE REACTOR CAN BE REALIZED. THE RESULTS OF THIS STUDY TO DATE INDICATE THAT DATA RELATING TO THE PROPERTIES OF STEELS IRRADIATED IN OR NEAR THE CORE OF PRESSURIZED LIGHT WATER MODERATED REACTORS CAN BE CONFIDENTLY INTERCOMPARED FOR ENGINEERING APPLICATIONS ASSUMING A FISSION SPECTRUM AND ACCOUNTING FOR NEUTRONS OF ENERGIES >1 MEV. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-639 835 18/10 11/6
NAVAL RESEARCH LAB WASHINGTON D C

IRRADIATION EFFECTS ON REACTOR STRUCTURAL MATERIALS. (U)

DESCRIPTIVE NOTE: QUARTERLY PROGRESS REPT., 1 MAY-31 JUL 66.
AUG 66 39P STEELE, LENDELL E. ; HAWTHORNE, J. RUSSELL ; GRAY, ROBERT A., JR. ; KLIER, EUGENE P. ; SERPAN, CHARLES Z., JR.
REPT. NO. NRL-MR-1719,
PROJ: RRU07-01-45-5409, SF-020-01-05-0858

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: RESEARCH SUPPORTED IN PART BY AEC CONTRACT AT(49-5)-2110.

DESCRIPTORS: (*RADIATION DAMAGE, *REACTOR MATERIALS), (*REACTOR SYSTEM COMPONENTS, REACTOR MATERIALS), STEEL, EMBRITTLEMENT, TENSILE PROPERTIES (U)

THE RESEARCH PROGRAM OF THE NRL METALLURGY DIVISION, REACTOR MATERIALS BRANCH, IS DEVOTED TO THE DETERMINATION OF THE EFFECTS OF NUCLEAR RADIATION UPON THE PROPERTIES OF STRUCTURAL MATERIALS. THE OVERALL PROGRAM IS SPONSORED BY THE OFFICE OF NAVAL RESEARCH, THE NAVAL SHIP SYSTEMS COMMAND, THE U. S. ATOMIC ENERGY COMMISSION, AND THE ARMY NUCLEAR POWER PROGRAM. SINCE RESEARCH FINDINGS WHICH APPLY TO THE OBJECTIVES OF ONE SPONSORING AGENCY ARE ALSO OF INTEREST TO THE OTHERS, THE OVERALL PROGRAM PROGRESS IS REPORTED HEREIN. THIS REPORT INCLUDES THE FOLLOWING: (1) RESULTS OF A COMPARATIVE IRRADIATION OF WELD HEAT AFFECTED ZONE AND BASE METAL SPECIMENS OF HY-80 STEEL, (2) PRELIMINARY DATA ON THE NOTCH DUCTILITY CHARACTERISTICS OF IRRADIATED MARAGING AND NICKEL-COBALT STEELS, (3) TENSILE PROPERTIES OF SELECTED STEELS HAVING POTENTIAL FOR NUCLEAR STRUCTURAL APPLICATION, (4) IRRADIATION DAMAGE SURVEILLANCE RESULTS FROM SPECIMENS EXPOSED NEAR THE YANKEE REACTOR PRESSURE VESSEL, AND (5) DESCRIPTION OF THE RECENTLY COMPLETED METALLOGRAPHIC CELL OF THE NRL HIGH LEVEL RADIATION LABORATORY. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-640 615 18/8 18/10 11/6
NAVAL RESEARCH LAB WASHINGTON D C

NEUTRON IRRADIATION EMBRITTLEMENT OF SEVERAL HIGHER STRENGTH STEELS, (U)

SEP 66 22P STEELE, LENDELL E. ;
HAWTHORNE, J. RUSSELL ;GRAY, ROBERT A. , JR.
REPT. NO. NRL-6419,
CONTRACT: AT(49-5)-2110,
PROJ: R 007-01-46-5409,SF020-01-05-0858

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*STEEL, *RADIATION DAMAGE), MARAGING STEELS, TRANSITION TEMPERATURE, PRESSURE VESSELS, EMBRITTLEMENT, NEUTRONS, PRESSURIZED WATER REACTORS, DUCTILITY, MECHANICAL PROPERTIES (U)

SEVERAL STEELS REPRESENTATIVE OF RECENTLY DEVELOPED TYPES AND HAVING POTENTIAL FOR NUCLEAR STRUCTURAL APPLICATIONS WERE EXPOSED TO HIGH ENERGY NUCLEAR RADIATION, AND THE RESULTANT PROPERTIES WERE COMPARED WITH THOSE OF THE CURRENTLY USED A212-B AND A302-B NUCLEAR REACTOR PRESSURE VESSEL STEELS. PRELIMINARY RESULTS FROM SEVERAL COMPARATIVE IRRADIATION EXPERIMENTS INDICATE THAT CERTAIN HIGHER STRENGTH STEELS, IN ADDITION TO HAVING INITIAL QUALITIES OF HIGHER STRENGTH AND LOWER INITIAL DUCTILE-BRITTLE TRANSITION TEMPERATURES, SHOW SMALLER EMBRITTLEMENT, EARLIER EMBRITTLEMENT SATURATION, AND A SUPERIOR OVERALL RESPONSE TO IRRADIATION AT 550F THAN THAT OBSERVED FOR THE STEELS IN CURRENT REACTOR PRESSURE VESSELS. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-641 283 18/10 18/12
NAVAL RESEARCH LAB WASHINGTON D C

NEUTRON SPECTRAL CONSIDERATIONS AFFECTING PROJECTED ESTIMATES OF RADIATION EMBRITTLEMENT OF THE ARMY SM-1A REACTOR PRESSURE VESSEL. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
SEP 66 31P SERPAN,C. Z. ,JR.;STEELE,L. E.
;
REPT. NO. NRL-6474,
PROJ: USA-ERG-4-66,

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*EMBRITTLEMENT, STEEL), (*PRESSURE VESSELS, *PRESSURIZED WATER REACTORS), (*RADIATION DAMAGE, *STEEL), REACTOR MATERIALS, NEUTRON REACTIONS, POWER REACTORS, ARMY, ALASKA (U)
IDENTIFIERS: ARMY REACTORS(SM-1A) (U)

THE PRESSURE VESSEL OF THE ARMY SM-1A REACTOR IS LOCATED CLOSE TO THE ACTIVE CORE IN SUCH A MANNER THAT THE NEUTRON EXPOSURE IS RELATIVELY HIGH; CONSEQUENTLY, THE PRESSURE VESSEL STEEL UNDERGOES A RELATIVELY RAPID RISE IN THE DUCTILE-BRITTLE TRANSITION TEMPERATURE. THE MAXIMUM PERMISSIBLE DELTA NDT FOR THE SM-1A IS ESTABLISHED BY THE ARMY AS 340F. SINCE IT IS PHYSICALLY IMPOSSIBLE TO IRRADIATE SURVEILLANCE TEST SPECIMENS AT THE SM-1A VESSEL WALL, ONLY THE NEUTRON FLUX WAS MEASURED AT THE WALL, AND REPRESENTATIVE TEST SPECIMENS WERE IRRADIATED IN A TEST REACTOR, THE LOW INTENSITY TEST REACTOR (LITR). IN TRANSLATING THE DELTA NDT VERSUS NEUTRON EXPOSURE DATA FROM THE LITR TO THE CASE OF THE SM-1A REACTOR VESSEL WALL, THE NEUTRON SPECTRA OF THE TWO REACTORS WERE USED TO ADJUST BOTH THE SM-1A REACTOR VESSEL FLUX AND THE LITR EXPOSURE VALUES IN TERMS OF N/SQ CM < 1.0, 0.5, AND 0.183 MEV. SINCE THE DISTRIBUTION OF NEUTRONS BY ENERGY GROUPS WAS DIFFERENT WITHIN EACH REACTOR AT THE SPECIFIC LOCATION OF INTEREST, THAT IS, THE VESSEL WALL OF THE SM-1A AND AN IN-CORE LOCATION OF THE LITR, THE DAMAGING POTENTIAL OF THE SM-1A REACTOR SPECTRUM LOCATION WAS RELATED TO THAT OF THE LITR, WITH DAMAGE EQUIVALENCE ESTABLISHED BETWEEN THE TWO REACTORS, A CRITICAL NEUTRON EXPOSURE (N/SQ CM > 0.5 MEV) MAY BE PROJECTED FOR PRODUCING THE MAXIMUM DELTA NDT ON THE SM-1A REACTOR VESSEL WALL. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-641 315 11/6
ROYAL AIRCRAFT ESTABLISHMENT FARNBOROUGH (ENGLAND)

A STUDY OF THE SIZE EFFECT IN THE PLATING EMBRITTLEMENT OF HIGH STRENGTH STEELS. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
JUN 66 22P DAVIS,H. C. ;GRAY,JOSEPHINE A. ;
REPT. NO. TR-66168

UNCLASSIFIED REPORT

DESCRIPTORS: (*STEEL, EMBRITTLEMENT), PLATING, CADMIUM, NICKEL ALLOYS, CHROMIUM ALLOYS, MOLYBDENUM ALLOYS, VANADIUM ALLOYS, LOADING(MECHANICS), TESTS, LIFE EXPECTANCY, STRESSES, FRACTURE(MECHANICS), GREAT BRITAIN (U)

THE REPORT DESCRIBES SUSTAINED LOAD TESTS MADE ON CADMIUM PLATED NOTCHED (K SUB T = 3.2) SPECIMENS 1/4 IN AND 1 IN DIAMETER, TWO STEELS WERE STUDIED, EN 24 AND NCMV HEAT TREATED TO 120 TON/SQ IN TS. THE RESULTS SHOWED THAT EN 24 WAS VERY SUSCEPTIBLE TO PLATING EMBRITTLEMENT, THE MAXIMUM STRESS FOR UNLIMITED LIFE BEING IN THE REGION OF 43 TON/SQ IN (308 NTS). NCMV STEEL WAS FOUND TO BE LESS SENSITIVE HAVING A CORRESPONDING VALUE OF 62-70 TON/SQ IN (40 TO 458 NTS). COMPARATIVE TESTS ON NCMV STEEL SHOWED NO SIGNIFICANT DIFFERENCE BETWEEN THE LIVES OF LARGE AND SMALL SPECIMENS. IN DETERMINING THE LIFE UNDER SUSTAINED LOAD, A MINIMUM TESTING TIME OF 500 HR WAS FOUND TO BE NECESSARY. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-642 290 11/6 18/8 18/10
NAVAL RESEARCH LAB WASHINGTON D C

INITIAL EVALUATIONS OF METALLURGICAL VARIABLES AS POSSIBLE FACTORS CONTROLLING THE RADIATION SENSITIVITY OF STRUCTURAL STEELS, (U)

SEP 66 40P HAWTHORNE,J. R. ;STEELE,L. E.

REPT. NO. NRL-6420
CONTRACT: AT(49-5)-2110
PROJ: RRUC-01-46-5409

UNCLASSIFIED REPORT

DESCRIPTORS: (*STEEL, *RADIATION DAMAGE), REACTOR MATERIALS, PRESSURE VESSELS, SENSITIVITY, DUCTILITY, EMBRITTLEMENT, NEUTRONS, HEAT TREATMENT, MICROSTRUCTURE (U)
IDENTIFIERS: STEEL A302-B (U)

EXPERIMENTAL INVESTIGATIONS FOR THE ISOLATION AND ASSESSMENT OF METALLURGICAL FACTORS CAUSING VARIABLE RADIATION EMBRITTLEMENT SENSITIVITY OF REACTOR STRUCTURAL STEELS WERE UNDERTAKEN, USING BOTH LARGE-TONNAGE COMMERCIAL HEATS AND SPECIAL LABORATORY HEATS OF STEEL. METALLURGICAL VARIABLES BEING EVALUATED INCLUDE THE IDENTITY AND QUANTITY OF MAJOR ALLOYING ELEMENTS AND OF RESIDUAL ELEMENTS, STEEL-MAKING PRACTICE--BOTH MELTING (REFINING) AND HEAT TREATMENT PRACTICE, MICROSTRUCTURE, AND GAS CONTENT. EXPERIMENTAL RESULTS FROM THE INITIAL SERIES OF THE EXPLORATORY SCREENING STUDIES DEMONSTRATE THAT THE RADIATION SENSITIVITY OF A STEEL CAN BE ALTERED APPRECIABLY THROUGH HEAT TREATMENT PRACTICES AND THAT MICROSTRUCTURE PLAYS A DOMINANT, IF NOT THE MOST INFLUENTIAL, ROLE IN RADIATION SENSITIVITY DEVELOPMENT. A TEMPERED MARTENSITE STRUCTURE WAS NOTED TO BE GENERALLY LESS RADIATION SENSITIVE THAN TEMPERED UPPER BAINITE AND FERRITE STRUCTURES. THE DATA ALSO INDICATE THAT VACUUM MELTING AND THE MINIMIZATION OF RESIDUAL ELEMENT CONTENT YIELDS STEELS HAVING A SUPERIOR IRRADIATION PERFORMANCE COMPARED WITH STEELS PRODUCED BY CONVENTIONAL OPEN HEARTH MELTING. HOWEVER, LONG-TERM STRESS RELIEVING HEAT TREATMENTS WERE NOT FOUND TO ALTER THE IRRADIATION RESPONSE OF A302-B STEEL.
(AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-643 082 11/6
ARMY MATERIALS RESEARCH AGENCY WATERTOWN MASS

MECHANICAL PROPERTIES AND FRACTURE SURFACE TOPOGRAPHY OF A THERMALLY EMBRITTLED STEEL. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
SEP 66 36P CARR,FRANK L. ;NUNES,JOHN ;
LARSON,FRANK R. ;
REPT. NO. AMRA-TR-66-28
PROJ: DA-1A0105018010

UNCLASSIFIED REPORT

DESCRIPTORS: (*STEEL, EMBRITTLEMENT), MECHANICAL PROPERTIES, FRACTURE(MECHANICS), TENSILE PROPERTIES, FRACTOGRAPHY, DUCTILITY, GRAIN STRUCTURES(METALLURGY), BRITTLENESS, IMPACT TESTS, NOTCH SENSITIVITY (U)
IDENTIFIERS: STEEL 3140 (U)

TENSILE FLOW AND FRACTURE PROPERTIES OF 3140 STEEL IN BOTH THE UNEMBRITTLED AND EMBRITTLED CONDITIONS ARE PRESENTED AND DISCUSSED. CHARPY IMPACT PROPERTIES WHICH REFLECT THE INFLUENCE OF THERMAL EMBRITTLEMENT ON THE TRANSITIONAL BEHAVIOR ARE PRESENTED. FRACTURE SURFACE TOPOGRAPHY IS DESCRIBED. QUANTITATIVE DATA RESULTED IN TRANSITIONAL CURVES FOR ALL THREE TYPES OF SPECIMENS UTILIZED. THIS FRACTURE SURFACE TOPOGRAPHY ALSO INDICATES THAT INTERGRANULAR FRACTURE HAS VARYING DEGREES OF DEFORMATION, DUCTILITY, AND ENERGY REQUIRED FOR SEPARATION. SEVERAL ASPECTS OF THERMAL EMBRITTLEMENT ARE DISCUSSED RELATIVE TO THE OBSERVATIONS MADE IN THIS STUDY. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1Z8ML1

AD-646 662 18/10 14/6 18/8
NAVAL RESEARCH LAB WASHINGTON D C

IRRADIATION EFFECTS ON REACTOR STRUCTURAL MATERIALS. (U)

DESCRIPTIVE NOTE: QUARTERLY PROGRESS REPT., 1 AUG-31 OCT 66,
NOV 66 30P STEELE,L. E. ;HAWTHORNE,J. R. ;SERPAN,C. Z. ;GRAY,R. A. ;
REPT. NO. NRL-MR-1731
PROJ: RR-007-01-46-5409 ,SF-020-01-05-0858

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO AD-669 839.

DESCRIPTORS: (*STEEL, *RADIATION DAMAGE), (*REACTOR MATERIALS, RADIATION DAMAGE), STAINLESS STEEL, NICKEL ALLOYS, CHROMIUM ALLOYS, MOLYBDENUM ALLOYS, WELDS, EMBRITTLEMENT, STRUCTURAL PARTS, DUCTILITY, NUCLEAR RADIATION (U)

THE RESEARCH PROGRAM OF THE NRL METALLURGY DIVISION, REACTOR MATERIALS BRANCH, IS DEVOTED TO THE DETERMINATION OF THE EFFECTS OF NUCLEAR RADIATION UPON THE PROPERTIES OF STRUCTURAL MATERIALS. THE OVERALL PROGRAM IS SPONSORED BY THE OFFICE OF NAVAL RESEARCH, THE NAVAL SHIP SYSTEMS COMMAND, THE U. S. ATOMIC ENERGY COMMISSION, AND THE ARMY NUCLEAR POWER PROGRAM. SINCE RESEARCH FINDINGS WHICH APPLY TO THE OBJECTIVES OF ONE SPONSORING AGENCY ARE ALSO OF INTEREST TO THE OTHERS, THE OVERALL PROGRAM PROGRESS IS REPORTED HEREIN. THIS REPORT, COVERING RESEARCH FOR THE PERIOD 1 AUGUST - 31 OCTOBER 1966, INCLUDES THE FOLLOWING: (1) A COMPARATIVE RESPONSE OF A302-B AND SEVERAL HIGHER STRENGTH STEELS AFTER IRRADIATION AT 200F AND AT 550F, (2) A COMPARATIVE EVALUATION OF THE NOTCH DUCTILITY OF 3-1/2NI-CR-MO WELD AND BASE PLATE AFTER IRRADIATION AT 200F AND AT 550F, (3) THE NOTCH DUCTILITY CHARACTERISTICS OF IRRADIATED AISI 304L AND 347 STAINLESS STEELS AFTER EXPOSURE TO 1 AND 10 X 10 TO THE 19TH POWER, (4) THE RESPONSE OF A350-LF1 (MODIFIED) STEEL TO CYCLIC IRRADIATION AND ANNEALING TREATMENT, AND (5) THE THROUGH-THICKNESS EMBRITTLEMENT AND NEUTRON FLUX VARIATIONS IN A SIMULATED WALL OF A REACTOR PRESSURE VESSEL. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-650 204 11/6
FRANKFORD ARSENAL PHILADELPHIA PA PITMAN-DUNN RESEARCH LABS

THE EFFECT OF GRAIN BOUNDARY PENETRATION ON THE DELAYED FAILURE OF CU-2% BE, (U)

JUN 66 12P RINNOVATORE,JAMES V. ;
CORRIE,JOHN D. ;MARKUS,HAROLD ;
PROJ: DA-1C014501B32A
MONITOR: FA A66-17

UNCLASSIFIED REPORT
AVAILABILITY: PUBLISHED IN TRANSACTIONS QUARTERLY V59 N4 P665-71 DEC 1966.

DESCRIPTORS: (*COPPER ALLOYS, *FAILURE(MECHANICS)), BERYLLIUM ALLOYS, LIQUID METALS, GRAIN BOUNDARIES, PENETRATION, EMBRITTLEMENT (U)

THE DELAYED FAILURE CHARACTERISTICS OF CU-2% BE IN THE PRESENCE OF A HG-2% NA AMALGAM WAS STUDIED. IT WAS SHOWN THAT GRAIN BOUNDARY PENETRATION OCCURS IN DELAYED FAILURE AND THAT A CRITICAL DEPTH OF PENETRATION IS NECESSARY FOR EMBRITTLEMENT. IT WAS ALSO SHOWN THAT THE CRITICAL DEPTH OF PENETRATION IS RELATED INVERSELY TO THE APPLIED STRESS. GRAIN BOUNDARY PENETRATION, HOWEVER, WAS NOT SUFFICIENT BY ITSELF TO PRODUCE EMBRITTLEMENT. ALTHOUGH THE CONCEPT THAT A CRITICAL DEPTH OF PENETRATION IS NECESSARY TO PRODUCE EMBRITTLEMENT IS VALID, IT WAS SHOWN THAT THE GRIFFITH EQUATION OF CRACK PROPAGATION IS NOT DIRECTLY APPLICABLE TO THE PHENOMENON OF DELAYED FAILURE. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. IZBML1

AD-650 349 18/10 18/8 11/6
NAVAL RESEARCH LAB WASHINGTON D C

IRRADIATION EFFECTS ON REACTOR STRUCTURAL MATERIALS. (U)

DESCRIPTIVE NOTE: QUARTERLY REPT. NO. 7, 1 NOV 66-31 JAN 67,
FEB 67 45P HAWTHORNE,J. R. ;SERPAN,C. Z. , JR.;WATSON,H. E. ;GRAY,R. A. , JR;
REPT. NO. NRL-MR-1753
PROJ: RR-007-01-46-5409; SF-020-01-05-0858

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO AD-646 662.

DESCRIPTORS: (•STEEL, RADIATION DAMAGE), (•RADIATION DAMAGE, •REACTOR MATERIALS), EMBRITTLEMENT, NEUTRONS, DUCTILITY, TENSILE PROPERTIES, STRESSES (U)
IDENTIFIERS: STAINLESS STEEL A302-B (U)

THE REPORT, COVERING RESEARCH FOR THE PERIOD 1 NOVEMBER 1966-31 JANUARY 1967, INCLUDES THE FOLLOWING: (1) EXERIMENTAL A302-B STEEL HEATS INSENSITIVE TO 550F IRRADIATION, (2) RADIATION EMBRITTLEMENT OF STEELS UNDER CYCLIC VERSUS CONSTANT TEMPERATURE EXPOSURE CONDITIONS, (3) EFFECTS OF APPLIED STRESS DURING IRRADIATION ON THE NOTCH DUCTILITY OF A302-B STEEL, (4) TENSILE PROPERTY CHANGES THROUGH THE WALL THICKNESS OF A SIMULATED REACTOR PRESSURE VESSEL, (5) COMPARISON OF NEUTRON FLUX VALUES FOR FISSION VERSUS THRESHOLD-TYPE MONITORS, AND (6) EQUIPMENT AND PROCEDURES DEVELOPED FOR ELEVATED TEMPERATURE REMOTE TENSION TESTING OF RADIOACTIVE SPECIMENS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. !ZBML!

AD-651 066 11/6
ARMY MATERIALS RESEARCH AGENCY WATERTOWN MASS

TEMPERED MARTENSITE EMBRITTLEMENT AND FRACTURE TOUGHNESS IN 4340 STEEL. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
JAN 67 29P KULA,ERIC B. !ANCTIL,
ALBERT A.; !
REPT. NO. AMRA-TR-67-03
PROJ: DA-1C024401A328

UNCLASSIFIED REPORT

DESCRIPTORS: (*STEEL, *EMBRITTLEMENT), MARTENSITE, FRACTURE(MECHANICS), TOUGHNESS, TENSILE PROPERTIES (U)
IDENTIFIERS: STEEL 4340 (U)

TEMPERED MARTENSITE EMBRITTLEMENT (500 F EMBRITTLEMENT) WAS STUDIED IN 4340 STEEL BY MEANS OF CHARPY IMPACT, TENSION, AND FRACTURE TOUGHNESS TESTS CARRIED OUT OVER A RANGE OF TEST TEMPERATURES. EMBRITTLEMENT WAS SHOWN IN THE IMPACT TESTS BY A MINIMUM IN ROOM TEMPERATURE IMPACT PROPERTIES FOR TEMPERING TEMPERATURES RANGING FROM 500 TO 650 F, THE SAME RANGE FOR WHICH THE TRANSITION TEMPERATURE IS A MAXIMUM. NO EVIDENCE OF EMBRITTLEMENT WAS FOUND IN TENSION OR ROOM TEMPERATURE FRACTURE TOUGHNESS TESTS. EMBRITTLEMENT WAS NOTED, HOWEVER, IN FRACTURE TOUGHNESS TESTS CARRIED OUT AT -50 AND -100 F, WHICH INDICATES THAT LOW TEMPERATURE TESTING WILL BE NECESSARY FOR PROPER MATERIALS EVALUATION. THE PLANE STRAIN FRACTURE TOUGHNESS (K SUB IC) OF VARIOUS HEATS OF 4340 STEEL HAS BEEN CORRELATED WITH THE WEIGHT PERCENT SULFUR AND PHOSPHORUS IN THE STEEL. A MECHANISM FOR TEMPERED MARTENSITE EMBRITTLEMENT IS PROPOSED. CERTAIN IMPURITY ELEMENTS, SUCH AS PHOSPHORUS, WHICH ARE MORE SOLUBLE IN FERRITE THAN IN CEMENTITE, WILL SEGREGATE IN THE FERRITE ADJACENT TO THE CEMENTITE SHORTLY AFTER THE CEMENTITE PRECIPITATION. THIS TRANSIENT ENRICHMENT OF FERRITE BY IMPURITY ELEMENTS WILL BE EMBRITTLING WHEN THE CEMENTITE IS IN A PLATELET OR FILMY FORM, AND PARTICULARLY SO IN THE REGION OF THE PRIOR AUSTENITE GRAIN BOUNDARIES, WHERE THE IMPURITY CONTENT MAY BE HIGHER THAN AVERAGE. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ?ZBML?

AD-653 156 11/6 13/8
FRANKFORD ARSENAL PHILADELPHIA PA

METHODS FOR MINIMIZING THE EMBRITTLING EFFECT OF HYDROGEN IN ELECTROPLATED HIGH STRENGTH ALLOY STEEL ITEMS. (U)

DESCRIPTIVE NOTE: FINAL ENGINEERING REPT.,
MAR 63 37P DOUGHERTY,EDWARD E. ;
PROJ: IEP-60-6110-2

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: REPT. ON INDUSTRIAL ENGINEERING PROJ.

DESCRIPTORS: (*EMBRITTLEMENT, *STEEL), (*ALLOYS, STEEL), ELECTROPLATING, MECHANICAL PROPERTIES, HYDROGEN, STRUCTURAL PROPERTIES, CADMIUM, THEORY, CHROMIUM, TESTS (U)

THE PAPER CONTAINS METHODS FOR ELIMINATING HYDROGEN EMBRITTLEMENT OF CADMIUM AND CHROMIUM ELECTROPLATED ULTRA HIGH STRENGTH ALLOY STEEL ITEMS FOR CARTRIDGE OR PROPELLANT ACTUATED DEVICES. SINCE THE INITIATION OF THE PROJECT, IT HAS BEEN CONCLUDED THAT THE ONLY WAY TO COMPLETELY ELIMINATE HYDROGEN EMBRITTLEMENT IS TO AVOID COMPLETELY THE INTRODUCTION OF HYDROGEN INTO THE ITEM BEING PLATED. METHODS TO MINIMIZE EMBRITTLEMENT, TO THE POINT THAT IT WILL NOT INTERFERE WITH THE FUNCTION OF APPLICABLE ITEMS, HAVE BEEN DETERMINED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-653 454 13/8 20/11
NAVY MARINE ENGINEERING LAB ANNAPOLIS MD

STRESS-RELIEF EMBRITTLEMENT OF AX-140 AND E-11018 WELD METALS, (U)

MAR 67 29P ROSENSTEIN,ALAN H. ;ASCHE, W. H. ;

REPT. NO. MEL-116/67
PROJ: S-F020-01-01
TASK: 0720

UNCLASSIFIED REPORT

DESCRIPTORS: (*WELDS, STRESS RELIEVING), (*STRESS RELIEVING, *METALS), (*EMBRITTLEMENT, WELDS), THERMAL STRESSES, SURFACE PROPERTIES, TRANSITION TEMPERATURE, THICKNESS, STRESSES, TEMPERATURE, IMPACT TESTS, TIME, FRACTURE(MECHANICS), TOUGHNESS, ANALYSIS, TESTS (U)

AN ATTEMPT WAS MADE TO ARRIVE AT OPTIMUM STRESS-RELIEF TREATMENTS (MAXIMUM RELIEF OF RESIDUAL STRESS WITH MINIMUM INCREASE IN TRANSITION TEMPERATURE) FOR AX-140 AND E-11018 WELD METALS. STRESS-RELIEF OF E-11018 RESULTS IN ACCEPTABLE TOUGHNESS (ALTHOUGH SOFTENING MUST BE CONSIDERED), WHEREAS, STRESS-RELIEF OF AX-140 CAN PRODUCE SEVERE EMBRITTLEMENT. A SATISFACTORY THERMAL STRESS-RELIEF TREATMENT CANNOT BE SPECIFIED FOR WELDMENTS INVOLVING AX-140. WELD METAL PROPERTIES VARY THROUGH THE THICKNESS OF THE WELD. CENTER-OF-WELDMENT MATERIAL IS NOT AS TOUGH AS SURFACE MATERIAL IN THE AS-WELDED CONDITION AND EXHIBITS A GREATER SUSCEPTIBILITY TO STRESS-RELIEF EMBRITTLEMENT. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-656 578 18/10 11/6
NAVAL RESEARCH LAB WASHINGTON D C

IRRADIATION EFFECTS ON REACTOR STRUCTURAL MATERIALS. (U)

DESCRIPTIVE NOTE: QUARTERLY PROGRESS REPT. 1 FEB-30 APR 67,
MAY 67 62P HAWTHORNE,J. R. ;SERPAN,C. Z. , JR.;WATSON,H. E. ;GRAY,R. A. , JR;
REPT. NO. NRL-MR-1780
PROJ: RR-007-01-46-5409, SF-020-01-05-0858

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO AD-650 349.

DESCRIPTORS: (*REACTOR MATERIALS, *RADIATION DAMAGE), (*STEEL, RADIATION DAMAGE), NEUTRON REACTIONS, METAL PLATES, DUCTILITY, MARAGING STEELS, EMBRITTLEMENT, NOTCH SENSITIVITY, WELDS, ANNEALING, PRESSURE VESSELS, MILLING MACHINES, AUTOMATIC, TEST EQUIPMENT, REMOTE CONTROL SYSTEMS, POWER REACTORS, PRESSURIZED WATER REACTORS, HEAVY WATER REACTORS (U)
IDENTIFIERS: ARMY REACTORS(MH-1), ARMY REACTORS(SM-1), CAROLINAS-VIRGINIA TUBE REACTOR, STEEL A302-B, STEEL A350-LF1 (U)

THE REPORT INCLUDES THE FOLLOWING: (1) A COMPARISON OF THE RESPONSE OF SELECTED STRUCTURAL STEELS TO IRRADIATION AT 550 AND 650F TO HIGH NEUTRON FLUENCES, (2) THE THROUGH-THICKNESS CHARPY-V NOTCH DUCTILITY PERFORMANCE OF A 10-1/2-IN.-THICK PLATE OF IRRADIATED A302-B STEEL, (3) AN INVESTIGATION OF THE EFFECTS OF OXYGEN AND NITROGEN CONTENTS ON THE RADIATION EMBRITTLEMENT SENSITIVITY OF 7-1/2NI-CR-MO STEEL AT 250F, (4) THE NOTCH DUCTILITY BEHAVIOR OF IRRADIATED 12NI-5CR-3MO MARAGING STEEL WELDMENTS, (5) THE RESPONSE OF A350-LF1 (MODIFIED) STEEL TO POSTIRRADIATION ANNEALING AT TEMPERATURES IN THE RANGE OF 550 TO 590F, (6) THE NOTCH DUCTILITY BEHAVIOR OF A350-LF1 (MODIFIED) STEEL WITH CYCLIC 430F IRRADIATION-168 HOUR ANNEALING, (7) THE PREIRRADIATION MECHANICAL PROPERTIES OF THE MH-1A REACTOR PRESSURE VESSEL STEEL, (8) THE NOTCH DUCTILITY OF SEVERAL REACTOR STRUCTURAL STEELS AFTER IRRADIATION IN A HEAVY WATER MODERATED REACTOR, (9) THE MODIFICATION, INSTALLATION, AND INITIAL OPERATION OF A REMOTELY OPERATED, TAPE-CONTROLLED MILLING MACHINE. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-652 379 11/6
MCMASTER UNIV HAMILTON (ONTARIO) DEPT OF METALLURGY AND METALLURGICAL ENGINEERING

THE EMBRITTLEMENT OF COPPER-17 ATOMIC % ALUMINUM ALLOY BY LIQUID MERCURY. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
AUG 67 119P IVES,M. B. ;HANCOCK,P.
C. ;
REPT. NO. TR-9
CONTRACT: NONR-3925(00)

UNCLASSIFIED REPORT

DESCRIPTORS: (•EMBRITTLEMENT, •LIQUID METALS), (•COPPER ALLOYS, EMBRITTLEMENT), DEFORMATION, CRACKS, STRESSES, FRACTURE(MECHANICS), MERCURY, HARDENING, PLASTICITY, MICROSTRUCTURE, GRAIN STRUCTURES(METALLURGY), ALUMINUM ALLOYS (U)
IDENTIFIERS: COPPER ALLOY 17AL (U)

THE ROLE OF PLASTIC DEFORMATION IN THE INITIATION AND PROPAGATION OF CRACKS IN CU-17AL ALLOY EMBRITTLED BY LIQUID MERCURY HAS BEEN STUDIED. IT IS PROPOSED THAT EXTENSIVE PLASTIC DEFORMATION AND WORK HARDENING MUST OCCUR AT THE CRACK-TIP DURING PROPAGATION IN ORDER TO RAISE THE LOCAL FLOW STRESS TO A CRITICAL LEVEL AT WHICH THE MAXIMUM NORMAL STRESS IS EQUAL TO THE COHESIVE STRENGTH. STRONG INDICATION IS GIVEN THAT A 'CRITICAL APPLIED STRESS' CRITERION FOR FRACTURE IS NOT APPLICABLE FOR THIS MATERIAL. MICRO-CRACKS ARE FORMED AT WEAKENED GRAIN BOUNDARIES AND A PERIOD OF STABLE CRACK GROWTH MADE OVER A PERIOD OF INCREASING APPLIED STRESS MAY BE NECESSARY BEFORE THE CRACK IS LONG ENOUGH TO BECOME UNSTABLE. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-657 854 7/4 11/6
NEW YORK UNIV N Y RESEARCH DIV

STUDY OF THE EFFECT OF LIQUID ENVIRONMENT ON THE EMBRITTLEMENT OF SOLIDS. (U)

DESCRIPTIVE NOTE: FINAL REPT. 1 JAN 59-31 DEC 66,
JUN 67 63P CADOFF,I. B. ;
CONTRACT: NONR-285(43)
PROJ: RR-007-08-01

UNCLASSIFIED REPORT

DESCRIPTORS: (*EMBRITTLEMENT, *SOLIDS), (*LIQUIDS, EMBRITTLEMENT), COPPER ALLOYS, MERCURY, LIQUID METALS, MICROSTRUCTURE, GRAIN SIZE, ADSORPTION, GRAIN BOUNDARIES, STRESSES, FRACTURE(MECHANICS), SILVER COMPOUNDS, CHLORIDES, SOLUTIONS, DUCTILITY, MERCURY ALLOYS (U)

THE EFFECT OF ENVIRONMENT ON THE MECHANICAL PROPERTIES OF SOLIDS WAS INVESTIGATED. THE TWO PRINCIPAL SYSTEMS STUDIED WERE: THE EMBRITTLEMENT OF COPPER AND COPPER ALLOYS IN MERCURY AND MERCURY AMALGAMS. THE EMBRITTLEMENT OF SILVER CHLORIDE IN AQUEOUS SOLUTIONS. THE PRINCIPAL FACTORS STUDIED WERE ALLOY COMPOSITION; MICROSTRUCTURE, INCLUDING GRAIN SIZE, PRECIPITATION EFFECTS, GRAIN BOUNDARY ORIENTATION RELATIONSHIPS; AND COMPOSITION OF THE LIQUID ENVIRONMENT. IN GENERAL IT WAS FOUND THAT EMBRITTLEMENT COULD BE ATTRIBUTED TO ADSORPTION OF 'ACTIVE' IONS AT SITES OF HIGH STRESS CONCENTRATION IN THE SOLID, WITH THIS ADSORPTION RESULTING IN LOWER COHESION BETWEEN SOLID-SOLID BONDS. HIGH STRESS CONCENTRATIONS ARE ASSOCIATED WITH THE DISLOCATION INTERACTIONS AT HIGH ANGLE GRAIN BOUNDARIES, PRECIPITATES AND NOTCHES. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-658 019 11/6 18/8 18/10
NAVAL RESEARCH LAB WASHINGTON D C

THROUGH-THICKNESS NOTCH DUCTILITY AND TENSION PROPERTIES AS A FUNCTION OF NEUTRON EXPOSURE TO A SIMULATED PRESSURE VESSEL WALL OF A302-B STEEL. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
JUN 67 18P SERPAN,CHARLES Z. , JR.;
HAWTHORNE,J. RUSSELL ;
REPT. NO. NRL-6575
PROJ: SF-020-01-05-0858; RR-007-01-46-5409

UNCLASSIFIED REPORT

DESCRIPTORS: (*STEEL, *RADIATION DAMAGE), PRESSURE VESSELS, DUCTILITY, EMBRITTLEMENT, NOTCH SENSITIVITY, TENSILE PROPERTIES, NEUTRON REACTIONS, POWER REACTORS, LIGHT WATER REACTORS, THICKNESS (U)
IDENTIFIERS: STEEL A302-B (U)

NOTCH DUCTILITY AND TENSION-PROPERTY MEASUREMENTS HAVE BEEN MADE USING SPECIMENS IRRADIATED WITHIN A LARGE STEEL TEST ASSEMBLY SIMULATING THE PRESSURE-VESSEL WALL OF A LIGHT-WATER-MODERATED POWER REACTOR. THE A302-B STEEL SPECIMENS, SPACED AT INTERVALS THROUGH THE 6-IN. THICKNESS OF THE ASSEMBLY, SHOWED THE GREATEST EMBRITTLEMENT AND TENSILE PROPERTY CHANGES FROM IRRADIATION LOCATIONS NEAREST THE FUEL CORE, AND CORRESPONDINGLY SMALLER CHANGES FARTHER FROM THE CORE. MEASURED NEUTRON FLUXES OF ENERGIES GREATER THAN 1 MEV, BASED UPON AN ASSUMED FISSION SPECTRUM, COMPARED WELL WITH CALCULATED SPECTRUM NEUTRON FLUXES OF ENERGIES GREATER THAN 1 MEV FOR ALL TEST ASSEMBLY LOCATIONS, THUS PROVIDING THE BASIS FOR FUTURE ESTIMATES OF PROPERTY CHANGES THROUGH THE THICKNESS OF HEAVY-WALLED REACTOR PRESSURE VESSELS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-658 210 20/11 11/6
MARTIN CO BALTIMORE MD RESEARCH INST FOR ADVANCED STUDIES

ADSORPTION-INDUCED BRITTLE FRACTURE IN LIQUID METAL ENVIRONMENTS. (U)

DESCRIPTIVE NOTE: ANNUAL REPT.,
MAY 67 10UP WESTWOOD,ALBERT R. C. ;
PREECE,CAROLYN M. ;KAMDAR,MADHUSUDAN M. ;
REPT. NO. RIAS-TR-67-8C,
CONTRACT: DA-18-001-AMC-1109(X)

UNCLASSIFIED REPORT

DESCRIPTORS: (*EMBRITTLEMENT, LIQUID METALS), (*FRACTURE(MECHANICS), METALS), BRITTLENESS, CHEMICAL BONDS, ADSORPTION, SURFACE-ACTIVE SUBSTANCES, DIFFUSION, STRESSES, CRACKS, CRACK PROPAGATION, FATIGUE(MECHANICS), ALLOYS (U)

SOLID METALS CAN BE CAUSED TO BEHAVE IN A BRITTLE MANNER BY EXPOSURE TO A VARIETY OF PHYSICAL OR CHEMICAL ENVIRONMENTS. PERHAPS THE MOST DRAMATIC EXAMPLES OF SUCH EFFECTS, HOWEVER, RESULT FROM EXPOSURE TO SURFACE ACTIVE LIQUID METALS. SPECIMENS PRE-STRESSED ABOVE SOME CRITICAL VALUE FAIL VIRTUALLY INSTANTLY ON BEING WETTED BY AN APPROPRIATE LIQUID METAL, AND 'BRITTLE' CRACK PROPAGATION RATES OF ORDER 100 CM PER SEC. HAVE BEEN RECORDED IN OTHERWISE DUCTILE METALS UNDER SUCH ENVIRONMENTAL CONDITIONS. SUCH EFFECTS ARE PRESENTLY CONSIDERED TO RESULT FROM ADSORPTION-INDUCED REDUCTIONS IN THE COHESIVE STRENGTH OF ATOMIC BONDS AT REGIONS OF STRESS CONCENTRATION IN THE SOLID METAL, E.G. AT THE TIPS OF CRACKS OR IN THE VICINITY OF PILED UP GROUPS OF DISLOCATIONS. THIS PAPER DESCRIBES THE RESULTS OF A NUMBER OF RECENT INVESTIGATIONS ON THIS TYPE OF LIQUID-METAL EMBRITTLEMENT, AND DISCUSSES THE PREREQUISITES AND POSSIBLE MECHANISMS FOR ITS OCCURRENCE. ALSO DISCUSSED ARE THE EFFECTS OF SUCH VARIABLES AS CHEMICAL COMPOSITION OF THE SOLID AND LIQUID METAL PHASES, TEMPERATURE, PRESTRAIN, RATE OF LOADING, ETC., ON SEVERITY OF EMBRITTLEMENT, AND SUCH TOPICS AS THE POSSIBLE CORRELATION BETWEEN SEVERITY OF EMBRITTLEMENT AND ELECTRONEGATIVITY, THE USE OF 'INERT CARRIER' LIQUID METALS, POSSIBLE MEANS OF INHIBITING LIQUID-METAL EMBRITTLEMENT, AND CRITERIA FOR BRITTLE FAILURE. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. IZBMLI

AD-661 429 18/10 11/6
NAVAL RESEARCH LAB WASHINGTON D C

IRRADIATION EFFECTS ON REACTOR STRUCTURAL MATERIALS. (U)

DESCRIPTIVE NOTE: QUARTERLY PROGRESS REPT. 1 MAY-31 JUL 67;
AUG 67 47P HAWTHORNE,J. RUSSELL ; SERPAN,CHARLES Z. , JR.;WATSON,HENRY E. ; LOSS,FRANK J. ;POTAPOVS,ULDIS ;
REPT. NO. NRL-MR-1808
PROJ: SF-020-01-05-0858, RR-007-01-46-5409

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO AD-656 578.

DESCRIPTORS: (*REACTOR MATERIALS, *RADIATION DAMAGE), (*STEEL, RADIATION DAMAGE), PRESSURE VESSELS, METAL PLATES, NICKEL ALLOYS, CHROMIUM ALLOYS, MOLYBDENUM ALLOYS, VANADIUM ALLOYS, DUCTILITY, TENSILE PROPERTIES, EMBRITTLEMENT, AGING(MATERIALS), NEUTRONS, SENSITIVITY (U)

THE REPORT INCLUDES THE FOLLOWING: (1) THROUGH-THICKNESS RADIATION RESISTANCE OF TWO A533 GRADE B, CLASS 1 STEEL PLATES AT 550 F, (2) DIRECTIONAL NOTCH DUCTILITY PERFORMANCE OF IRRADIATED 3-1/2NI-CR-MO AND 5NI-CR-MO-V STEEL PLATES, (3) RADIATION SENSITIVITY OF A353 (9% NICKEL) STEEL AS INFLUENCED BY PERCENT RETAINED AUSTENITE, (4) TENSILE PROPERTIES BEHAVIOR VERSUS POSTIRRADIATION TEST TEMPERATURE OF SELECTED STRUCTURAL STEELS, (5) POTENTIAL FOR AGING EMBRITTLEMENT OF PRESSURE VESSEL STEELS, (6) POSTPRESSURIZATION TEST OPERATIONS ON PM-2A REACTOR PRESSURE VESSEL, AND (7) AUXILIARY EQUIPMENT DEVELOPED FOR ELEVATED TEMPERATURE REMOTE TENSION TESTING OF RADIOACTIVE SPECIMENS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. IZBML1

AD-661 463 11/6
NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER ANNAPOLIS MD
ANNAPOLIS DIV

EMBRITTLEMENT OF TITANIUM IN SEAWATER, (U)

OCT 67 48P CAVALLARO,J. L. ;
PROJ: S-F020-01-01
TASK: 1189, 0721
MONITOR: NSRDC 2483

UNCLASSIFIED REPORT

DESCRIPTORS: (*TITANIUM ALLOYS, EMBRITTLEMENT), (*STRESS CORROSION, TITANIUM ALLOYS), SEA WATER, MICROSTRUCTURE, FRACTURE(MECHANICS), RUPTURE, ALUMINUM ALLOYS, NIOBIUM ALLOYS, TANTALUM ALLOYS (U)
IDENTIFIERS: TITANIUM ALLOY 7AL2NB17A (U)

SEA-WATER STRESS- CORROSION TESTS ON NOTCHED CANTILEVER-BEAM SPECIMENS OF ALLOY TI-7AL-2CB-1TA (TI-721) DEMONSTRATED THAT IT HAS A TRANSITION IN BEHAVIOR WITH INCREASING NOTCH SHARPNESS. SEA-WATER TESTS ON ALLOY TI-721 INDICATE THAT A THRESHOLD STRESS LEVEL EXISTS BELOW WHICH STRESS CORROSION DOES NOT OCCUR. SEA-WATER STRESS CORROSION IS DEPENDENT ON THE PRESENCE OF EMBRITTLING CONSTITUENTS IN THE ALLOY. ALLOY CHEMISTRY AND HEAT TREATMENT ARE THE MOST SIGNIFICANT FACTORS WHICH CONTROL SENSITIVITY. THE RESULTS OF TESTS MADE ON A SERIES OF TI-AL BINARY ALLOYS INDICATE THAT ALUMINUM IN SOLID SOLUTION DOES NOT CAUSE STRESS CORROSION, BUT THAT IT IS CAUSED BY A FINITE AMOUNT OF A COHERENT TI3AL. A DECREASE IN ALUMINUM AND OXYGEN CONTENTS AND THE ADDITION OF ISOMORPHOUS BETA STABILIZERS IMPROVE THE RESISTANCE OF TI-AL ALLOYS TO SEA-WATER STRESS CORROSION BY SUPPRESSING THE FORMATION OF TI3AL. A STRESS-SORPTION CRACKING MECHANISM IS SUGGESTED AS A GENERAL MODEL FOR THE EMBRITTLEMENT OF TITANIUM AND TITANIUM ALLOYS IN SEAWATER. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-661 603 18/10 11/6 18/8
NAVAL RESEARCH LAB WASHINGTON D C

YANKEE REACTOR PRESSURE-VESSEL SURVEILLANCE: NOTCH DUCTILITY PERFORMANCE OF VESSEL STEEL AND MAXIMUM SERVICE FLUENCE DETERMINED FROM EXPOSURE DURING CORES II, III, AND IV, (U)

SEP 67 38P SERPAN,CHARLES Z. , JR.;
HAWTHORNE,J. R. ;
REPT. NO. NRL-6616
PROJ: RR-007-01-48-5409, SF-020-01-05-0858

UNCLASSIFIED REPORT

DESCRIPTORS: (*STEEL, RADIATION DAMAGE), (*RADIATION DAMAGE, *REACTOR MATERIALS), EMBRITTLEMENT, NEUTRON FLUX, DUCTILITY, TEMPERATURE, PRESSURE VESSELS, TRANSITION TEMPERATURE (U)
IDENTIFIERS: STEEL A-302-B, YANKEE ATOMIC POWER REACTOR (U)

CHARPY V-NOTCH SPECIMENS, REPRESENTATIVE OF ONE OF THE SEVERAL HEATS OF A302-B STEEL FORMING THE YANKEE REACTOR PRESSURE VESSEL AND IRRADIATED AS PART OF THE YANKEE SURVEILLANCE PROGRAM, WERE TESTED. SPECIMENS OF THIS PARTICULAR HEAT, IRRADIATED IN NEAR-CORE (ACCELERATED) AS WELL AS IN VESSEL-WALL LOCATIONS, SHOWED MORE EMBRITTLEMENT THAN DID SPECIMENS OF A REFERENCE STEEL HEAT OF THE SAME NOMINAL A302-B COMPOSITION IRRADIATED SIMULTANEOUSLY IN THE SAME SURVEILLANCE CAPSULES, THOSE SPECIMENS FROM BOTH THE YANKEE VESSEL HEAT AND THE REFERENCE HEAT IRRADIATED AT THE VESSEL-WALL LOCATION DEPICTED A HIGHER DAMAGE RATE THAN THAT FOR THE ACCELERATED LOCATION. THE CAUSE OF THIS DIFFERENCE IN EMBRITTLEMENT RESPONSE COULD NOT BE ATTRIBUTED TO AN EFFECT OF CYCLIC, SERVICE IRRADIATION TEMPERATURES, BUT COULD BE TRACED TO A QUALITATIVE RELATIONSHIP OF THERMAL TO FAST (>1 MEV) NEUTRON FLUXES. THIS RATIO WAS IN EXCESS OF ABOUT 9:1 AT THE VESSEL-WALL LOCATION VERSUS A RATIO LESS THAN ABOUT 9:1 FOR THE ACCELERATED LOCATION. THE COMPUTATION OF A MAXIMUM SERVICE FLUENCE OF 1.46X10 TO THE 19TH POWER N/SQ CM (>0.5 MEV) WAS MADE POSSIBLE BY ESTABLISHMENT OF THE NEUTRON SPECTRUM AT THE REACTOR VESSEL WALL USING COMPUTER CALCULATIONS. THE MAXIMUM FLUENCE DERIVED BY THIS TECHNIQUE COMPARED FAVORABLY WITH ANOTHER VALUE GIVEN BY AN INDEPENDENTLY-DEVELOPED CALCULATED (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-653 084 11/9 9/3 6/6
NAVAL RESEARCH LAB WASHINGTON D C

TERMITE RESISTANCE OF POLYVINYL CHLORIDE PLASTIC -, TWO YEARS' EXPOSURE IN THE TROPICS, (U)

OCT 67 19P BULTMAN,J. D. ;LEONARD,J. M. ;SOUTHWELL,C. R. ;
REPT. NO. NRL-6601
PROJ: Y-F015-06-03-201

UNCLASSIFIED REPORT

DESCRIPTORS: (*POLYVINYL CHLORIDE, TROPICAL TESTS), (*ELECTRIC INSULATION, TROPICAL TESTS), PLASTICS, TROPICAL DETERIORATION, ENVIRONMENTAL TESTS, PLASTICIZERS, INSECTICIDES, ADDITIVES, EMBRITTLEMENT, PEST CONTROL, ISOPTERA (U)

AN INVESTIGATION OF TERMITE ATTACK UPON POLYMERIC MATERIALS IS IN PROGRESS. SO FAR, THIRTY-TWO FORMULATIONS CONTAINING POLYVINYL CHLORIDE RESIN HAVE BEEN PREPARED INCORPORATING, VARIOUSLY FOUR PLASTICIZERS, THREE TOXICANTS AND TWO DEGREES OF HARDNESS. OF THE 480 SPECIMENS EXPOSED FOR ABOUT TWO YEARS IN THE PANAMA JUNGLE, 122 SPECIMENS (25%) SHOW EVIDENCE OF ATTACK, RANGING FROM LIGHT TO HEAVY, ALTHOUGH IN GENERAL THE ATTACK WAS LIGHT. SEVENTY-SEVEN OF THE DAMAGED SPECIMENS CONTAINED NO TOXICANT. OF THE TOXICANTS, LINDANE WAS GENERALLY MORE EFFECTIVE THAN EITHER ALDRIN OR DIELDRIN. SPECIMENS CONTAINING DIOCTYL PHTHALATE PLASTICIZER HAD THE HIGHEST INCIDENCE OF ATTACK, ALTHOUGH, IN THE ABSENCE OF A TOXICANT, SPECIMENS CONTAINING OTHER PLASTICIZERS WERE ATTACKED NEARLY AS MUCH. NO SIGNIFICANT DIFFERENCE IN THE INCIDENCE OF ATTACK DEVELOPED BETWEEN THOSE SPECIMENS CONTAINING LOW AND HIGH PERCENTAGES OF SILICA. AFTER TWO YEARS' EXPOSURE, SPECIMEN SHRINKAGE OCCURRED IN ALL SAMPLES PLASTICIZED WITH DIOCTYL ADIPATE. THIS SHRINKAGE WAS ACCOMPANIED BY AN EMBRITTLEMENT WHICH PRESUMABLY ADDED TO TERMITE RESISTANCE. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-664 598 20/11 11/6 14/2
NATIONAL TECHNICAL UNIV ATHENS (GREECE) LAB FOR TESTING MATERIALS

THE EFFECT OF TORSIONAL PLESTRAIN ON THE EMBRITTLEMENT OF MILD STEEL. (U)

DESCRIPTIVE NOTE: FINAL TECHNICAL REPT. JUL 66-JUN 67,
JUN 67 24P THEOCARIS,PERICLES S. ;
CONTRACT: DA-91-591-EUC-4085
PROJ: DA-2001450183G

UNCLASSIFIED REPORT

DESCRIPTORS: (*STEEL, EMBRITTLEMENT), (*METALLURGICAL LABORATORIES, GREECE), CRACK PROPAGATION, FAILURE(MECHANICS), FRACTURE(MECHANICS), TORSION, DUCTILE BRITTLE TRANSITION, STRESSES, DEFORMATION, RODS, NOTCH TOUGHNESS (U)
IDENTIFIERS: PLESTRAIN(MECHANICS) (U)

THE PAPER PRESENTS THE RESULTS OF A SERIES OF TESTS ON NOTCHED SPECIMENS MADE OF LOW-CARBON DIN 37 STEEL, WHICH WERE TORSIONALLY PRESTRAINED BY DIFFERENT AMOUNTS AT THEIR PLAIN OR NOTCHED STATE AND THEN TESTED IN TENSION TO FAILURE. THESE TESTS SHOWED THE DELETERIOUS INFLUENCE OF PRETWISTING ON THE EXHAUSTION OF DUCTILITY OF THE METAL. IT WAS SHOWN THAT THE MOST EFFECTIVE MODE FOR EXHAUSTING THE DUCTILITY OF THE METAL WAS ACHIEVED WHEN PRETWISTED BARS WERE SHARPY NOTCHED AND TWISTED, BEFORE FRACTURING IN TENSION. GENUINE BRITTLE FRACTURES OCCURRING AT A NOMINAL STRESS LOWER THAN THE VIRGIN YIELD STRENGTH OF THE MATERIAL WERE CONSISTENTLY PRODUCED IN THIS MANNER. A SERIES OF PLAIN TORSION BARS SUBMITTED TO SEVERE TWISTING, FOLLOWED BY A GRADUAL REVERSE TORSION, SHOWED THAT THE FAILURE STRESSES OF THE SUBSEQUENTLY SLICED TENSION SPECIMENS PASSED THROUGH CONSECUTIVE RELATIVE MAXIMA AND MINIMA BEFORE REACHING A MAXIMUM FAILURE STRESS CORRESPONDING TO AN UNTWISTING ANGLE EQUAL TO THE INITIAL TWISTING. ALL FRACTURES IN THESE SPECIMENS WERE HIGH STRESS FAILURES. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-664 646 18/10
NAVAL RESEARCH LAB WASHINGTON D C

THE EFFECTS OF COUPLING NUCLEAR RADIATION WITH STATIC AND CYCLIC SERVICE STRESSES AND OF PERIODIC PROOF TESTING ON PRESSURE VESSEL MATERIAL BEHAVIOR. (U)

DESCRIPTIVE NOTE: PHASE I OF FINAL REPT.,
AUG 67 45P HAWTHORNE,J. R. ;LOSS,F. J. ;
REPT. NO. NRL-6620
PROJ: RR-007-01-46-5409, SF-020-01-05-0858

UNCLASSIFIED REPORT

DESCRIPTORS: (•REACTOR MATERIALS, •STEEL), (•PRESSURE VESSELS, •RADIATION DAMAGE), STRUCTURAL PARTS, NUCLEAR RADIATION, STRESSES, TEST METHODS, AGING(MATERIALS), FATIGUE(MECHANICS), TRANSITION TEMPERATURE, EMBRITTLEMENT, DUCTILITY, NEUTRON REACTIONS (U)
IDENTIFIERS: HYDRO-TESTING, STEEL A-302, STEEL A-350 (U)

THE NUCLEAR SERVICE PERFORMANCE OF STRUCTURAL STEELS AS INFLUENCED BY STATIC AND CYCLIC STRESS APPLICATIONS DURING RADIATION EXPOSURE WAS EXAMINED AND DOCUMENTED WITH EXPERIMENTAL RESULTS. THE SIGNIFICANCE AND MERITS OF INITIAL AND SUBSEQUENT PROOF TESTS OF LARGE STRUCTURAL COMPONENTS SUCH AS THE HYDRO-TESTING OF NUCLEAR REACTOR PRESSURE VESSELS WERE ALSO REVIEWED AND EVALUATED. PERFORMANCE FOLLOWING PRELOAD IN THE FORM OF WARM PRESTRESSING AS WELL AS AGING EMBRITTLEMENT WERE AMONG THOSE FACTORS CONSIDERED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-665 093 11/6
MARTIN CO BALTIMORE MD RESEARCH INST FOR ADVANCED STUDIES

CRITICAL SPECIES IN STRESS CORROSION PHENOMENA, (U)

67 23P PUGH,E. N. ;WESTWOOD,A. R. C. ;

CONTRACT: DA-31-124-ARO(D)-258
PROJ: DA-2001450B32D
MONITOR: AROD 5023:5

UNCLASSIFIED REPORT
AVAILABILITY: PUBLISHED IN STRESS CORROSION TESTING, SPECIAL TECHNICAL PUBLICATION, NO. 425 P228 1967.
SUPPLEMENTARY NOTE: RESEARCH SUPPORTED IN PART BY ONR.

DESCRIPTORS: (*STRESS CORROSION, FRACTURE(MECHANICS)), BRASS, STAINLESS STEEL, MAGNESIUM ALLOYS, ALUMINUM ALLOYS, CRACKS, CORROSION, CHLORIDES, FAILURE(MECHANICS), COMPLEX COMPOUNDS, AMMONIUM COMPOUNDS, SILVER COMPOUNDS, EMBRITTLEMENT, SOLUTIONS, PHYSICAL CHEMISTRY (U)

CONSIDERATION HAS BEEN GIVEN TO THE IDENTIFICATION OF THE CRITICAL SPECIES IN SEVERAL STRESS CORROSION SYSTEMS. IT IS SHOWN THAT IN THE ALPHA-BRASS/ AQUEOUS AMMONIA SYSTEM, CUPRIC COMPLEX IONS OF THE TYPE CU(NH3)N(2+) PLAY A CONTROLLING ROLE IN THE CRACKING PROCESS. COMPLEX IONS ARE ALSO FOUND TO CONSTITUTE THE CRITICAL SPECIES IN THE EMBRITTLEMENT OF SILVER CHLORIDE IN CERTAIN AQUEOUS ENVIRONMENTS. IN THE CASE OF MATERIALS SUCH AS STAINLESS STEELS AND MAGNESIUM AND ALUMINUM ALLOYS, WHICH UNDERGO STRESS CORROSION CRACKING IN CHLORIDE ENVIRONMENTS, THE CRITICAL SPECIES MAY BE THE CHLORIDE ION ITSELF OR METAL-CHLORIDE COMPLEXES. ATTENTION IS GIVEN TO BOTH THE ROLE OF THE CRITICAL SPECIES IN THE MECHANISMS OF FAILURE AND THE PRACTICAL SIGNIFICANCE OF THESE FINDINGS TO STRESS CORROSION TESTING. IT IS SUGGESTED THAT MORE ATTENTION TO THE CHEMISTRY OF ENVIRONMENTS WHICH CAUSE STRESS CORROSION CRACKING, WITH PARTICULAR REGARD TO THE IDENTIFICATION OF THE CRITICAL SPECIES, COULD BE OF SIGNIFICANT PRACTICAL VALUE. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-666 293 11/3 11/9
OLIN MATHIESON CHEMICAL CORP NEW HAVEN CONN CHEMICALS GROUP

DEVELOPMENT OF FLEXIBLE EPOXY RESINS AND COATINGS, (U)

DESCRIPTIVE NOTE: FINAL REPT. 1 MAR 67-29 MAR 68,
FEB 68 37P URS,S. VENKATARAMARAJ ;
PUGLIA,SALVATORE A. ;
CONTRACT: NOOO19-67-C-0295

UNCLASSIFIED REPORT

DESCRIPTORS: (*EPOXY PLASTICS, *PLASTIC COATINGS), MECHANICAL PROPERTIES, EMBRITTLEMENT, AGING(MATERIALS), ISOCYANATE PLASTICS, AIRCRAFT FINISHES, WEAR RESISTANCE (U)
IDENTIFIERS: POLYOXYALKYLENE DIAMINE, POLYOXYBUTYLENE DIAMINE, POLYOXYPROPYLENE DIAMINE (U)

COATINGS WITH EXCELLENT LOW TEMPERATURE FLEXIBILITY WERE MADE BY BLENDING 20 PARTS POLYETHER DIEPOXIDE DER 732 AND 80 PARTS AROMATIC EPOXY RESIN EPON 1001 AND CURING WITH POLYETHER DIAMINE POPDA 400. ALSO COATINGS WITH GOOD FLEXIBILITY AT -45F, HIGH ADHESION AND ABRASION RESISTANCE WERE PREPARED FROM MOISTURE-SET POLYTETRAMETHYLENE GLYCOL/TDI POLYURETHANES. HOWEVER, THESE COATINGS NEEDED LONG CURING TIMES. EPON 828 CURED WITH POLYETHER DIAMINE POPDA 400 AND POLYETHER TRIAMINE PPE 6400TA GAVE COATINGS WITH GOOD GLOSS AND HIGH ABRASION RESISTANCE. BUT, THE COATINGS HAD ONLY MARGINAL LOW TEMPERATURE PROPERTIES. ANTICIPATED HIGH TEMPERATURE RESISTANT COATINGS WERE NOT REALIZED FROM OXYDIPHENOL EPOXY RESINS. ALSO, THE RESINS HAD POOR SOLUBILITY PROPERTIES. A URETHANE-EPOXY HYBRID COATING WAS SYNTHESIZED WHICH SHOULD HAVE LOW TEMPERATURE FLEXIBILITY OF URETHANE POLYMERS AND THE FAST CURING RATE OF EPOXY RESINS. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-667 464 18/10 11/6
NAVAL RESEARCH LAB WASHINGTON D C

IRRADIATION EFFECTS ON REACTOR STRUCTURAL MATERIALS. (U)

DESCRIPTIVE NOTE: QUARTERLY PROGRESS REPT. 1 NOV 67-31 JAN 68,
FEB 68 51P HAWTHORNE,J. RUSSELL ; POTAPOVS,ULDIS ;SERPAN,CHARLES Z. , JR;
REPT. NO. NRL-MR-1853
PROJ: RR-007-01-46-5409, SF-020-01-05-0858

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO AD-663 888.

DESCRIPTORS: (*REACTOR MATERIALS, *RADIATION DAMAGE), (*STEEL, RADIATION DAMAGE), PRESSURE VESSELS, METAL PLATES, NICKEL ALLOYS, CHROMIUM ALLOYS, MOLYBDENUM ALLOYS, NOTCH TOUGHNESS, DUCTILITY, AGING(MATERIALS), EMBRITTLEMENT, ANNEALING, NEUTRON REACTIONS, SENSITIVITY (U)
IDENTIFIERS: A302-B STEEL, SM-1A REACTOR (U)

THE RESEARCH PROGRAM OF THE NRL METALLURGY DIVISION, REACTOR MATERIALS BRANCH, IS DEVOTED TO THE DETERMINATION OF THE EFFECTS OF NUCLEAR RADIATION UPON THE PROPERTIES OF STRUCTURAL MATERIALS. THE OVERALL PROGRAM IS SPONSORED BY THE OFFICE OF NAVAL RESEARCH, THE NAVAL SHIP SYSTEMS COMMAND, THE U. S. ATOMIC ENERGY COMMISSION, AND THE ARMY NUCLEAR POWER PROGRAM. SINCE RESEARCH FINDINGS WHICH APPLY TO THE OBJECTIVES OF ONE SPONSORING AGENCY ARE ALSO OF INTEREST TO THE OTHERS, THE OVERALL PROGRAM PROGRESS IS REPORTED HEREIN. THIS REPORT, COVERING RESEARCH FOR THE PERIOD 1 NOVEMBER 1967 - 31 JANUARY 1968, INCLUDES THE FOLLOWING: (1) AN EVALUATION OF COPPER, VANADIUM, AND NITROGEN CONTENT AS VARIABLES IN RADIATION EMBRITTLEMENT SENSITIVITY OF A302-B STEEL, (2) THE THERMAL AGING RESPONSE OF A302-B PLATES FROM A LABORATORY SPLIT HEAT MODIFIED WITH SULFUR AND PHOSPHORUS ADDITIONS, (3) AN EVALUATION OF THE EFFECT OF ALUMINUM AND NITROGEN ADDITIONS ON RADIATION EMBRITTLEMENT SENSITIVITY OF NI-CR-MO STEEL, (4) THE NOTCH DUCTILITY CHARACTERISTICS OF EXPERIMENTAL CR-NI-MO PRECIPITATION HARDENING STAINLESS STEEL AFTER < 250F IRRADIATION, AND (5) AN ASSESSMENT OF EMBRITTLEMENT RELIEF ACCOMPLISHED THROUGH IN-PLACE ANNEALING THE SM-1A REACTOR PRESSURE VESSEL. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-668 172 20/14
MARTIN MARIETTA CORP BALTIMORE MD RESEARCH INST FOR ADVANCED STUDIES

ADSORPTION-SENSITIVE MECHANICAL BEHAVIOR. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
MAR 68 35P WESTWOOD,ALBERT R. C. ;
PREECE,CAROLYN M. ;GOLDHEIM,DAVID L. ;
REPT. NO. RIAS-TR-68-6C
CONTRACT: NONR-4162(00)
PROJ: NR-036-055

UNCLASSIFIED REPORT

DESCRIPTORS: (•EMBRITTLEMENT, •ADSORPTION), (•LIQUID METALS, MECHANICAL PROPERTIES), (•CRYSTALS, MECHANICAL PROPERTIES), SILVER COMPOUNDS, CHLORIDES, CHEMISORPTION, CRACKS, COMPLEX COMPOUNDS, DISLOCATIONS, CARRIERS(SEMICONDUCTORS), MAGNESIUM OXIDES, LITHIUM FLUORIDES, CALCIUM FLUORIDES, HARDNESS (U)
IDENTIFIERS: REBINDER EFFECTS (U)

IT HAS BEEN SUGGESTED THAT CERTAIN TYPES OF ADSORPTION-SENSITIVE MECHANICAL BEHAVIOR MAY BE UNDERSTOOD, IN A GENERAL WAY, BY CONSIDERING THE TYPE, CONCENTRATION, MOBILITY AND ADSORPTION-INDUCED REDISTRIBUTION OF THE CHARGE CARRIERS IN THE SOLID. SOME RECENT EXPERIMENTAL OBSERVATIONS ON THE EMBRITTLEMENT OF AGCL, AND REBINDER EFFECTS (ADSORPTION-INDUCED REDUCTIONS IN MICROHARDNESS) IN IONIC CRYSTALS ARE DESCRIBED AND DISCUSSED IN TERMS OF THIS HYPOTHESIS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-671 094 18/8 11/6
NAVAL RESEARCH LAB WASHINGTON D C

IRRADIATION EFFECTS ON REACTOR STRUCTURAL MATERIALS. (U)

DESCRIPTIVE NOTE: QUARTERLY PROGRESS REPT. 1 FEB-30 APR 68,
MAY 68 41P STEELE ,L. E. ;HAWTHORNE , J. R. ;SERPAN,C. Z. , JR. ;POTAPOVS,ULDIS ;

REPT. NO. NRL-MR-1872
PROJ: RR007-01-46-5409

UNCLASSIFIED REPORT

DESCRIPTORS: (*NUCLEAR REACTORS, *STRUCTURAL PARTS), (*RADIATION DAMAGE, *PRESSURE VESSELS), STEEL, CHEMICAL PROPERTIES, NEUTRONS, EMBRITTLEMENT, ABSORPTION, DEPOSITS, MECHANICAL PROPERTIES, NICKEL ALLOYS, CHROMIUM ALLOYS, WELDS, MOLYBDENUM ALLOYS, NOTCH SENSITIVITY, DUCTILITY, IRON ALLOYS (U)
IDENTIFIERS: STEEL A302B, STEEL A533B, STEEL A350 (U)

THE RESEARCH PROGRAM OF THE NRL METALLURGY DIVISION, REACTOR MATERIALS BRANCH, IS DEVOTED TO THE DETERMINATION OF THE EFFECTS OF NUCLEAR RADIATION UPON THE PROPERTIES OF STRUCTURAL MATERIALS. THE OVERALL PROGRAM IS SPONSORED BY THE OFFICE OF NAVAL RESEARCH, THE U.S. ATOMIC ENERGY COMMISSION, AND THE ARMY NUCLEAR POWER PROGRAM. SINCE RESEARCH FINDINGS WHICH APPLY TO THE OBJECTIVES OF ONE SPONSORING AGENCY ARE ALSO OF INTEREST TO THE OTHERS, THE OVERALL PROGRAM PROGRESS IS REPORTED HEREIN. THIS REPORT, COVERING RESEARCH FOR THE PERIOD 1 FEBRUARY-30 APRIL 1968, INCLUDES THE FOLLOWING: (1) CONTROLLING THE RADIATION EMBRITTLEMENT SENSITIVITY OF NI-CR-MO WELD DEPOSITS BY VARYING THEIR CHEMICAL COMPOSITION, (2) INFLUENCE OF PRIOR TEMPER EMBRITTLEMENT ON THE IRRADIATION RESPONSE OF NI-CR-MO STEEL, (3) RELATIVE 550F IRRADIATION RESPONSE OF BASE PLATE, WELD METAL, AND WELD HEAT AFFECTED ZONE OF A 7-1/2-IN.-THICK A533-B CLASS 1 PRODUCTION WELDMENT, (4) DROP WEIGHT NDT VERSUS CHARPY-V ENERGY ABSORPTION LEVEL IN 6-3/8-IN. TYPE A533-B CLASS I AND II STEEL PLATE, AND (5) MECHANICAL PROPERTIES EVALUATION OF PM-2A REACTOR PRESSURE VESSEL STEEL. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-671 807 18/8 18/9 13/4
NAVAL RESEARCH LAB WASHINGTON D C

NOTCH DUCTILITY PROPERTIES OF SM-1A REACTOR PRESSURE VESSEL FOLLOWING THE IN-PLACE ANNEALING OPERATION. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
MAY 68 31P POTAPOVS,ULDIS ;HAWTHORNE,J.
RUSSELL ;SERPAN,CHARLES Z. , JR;
REPT. NO. NRL-6721
PROJ: USA-ERG-3-67, USA-ERG-19-66
TASK: M01-14

UNCLASSIFIED REPORT

DESCRIPTORS: (*PRESSURE VESSELS, *RADIATION DAMAGE), IMPACT TESTS, DUCTILE BRITTLE TRANSITION, NUCLEAR INDUSTRIAL APPLICATIONS, NON-DESTRUCTIVE TESTING, ANNEALING, MAPS, EMBRITTLEMENT, STEEL, NOTCH TOUGHNESS (U)
IDENTIFIERS: GRAPHS(CHARTS), SM-1A REACTOR VESSEL. (U)

THE EMBRITTLEMENT CONDITION OF THE ARMY SM-1A REACTOR PRESSURE VESSEL, AS MODIFIED BY THE RECENTLY COMPLETED IN-PLACE ANNEAL, WAS ASSESSED AND AN ANALYSIS WAS MADE OF THE REEMBRITTLEMENT BEHAVIOR OF THE VESSEL STEEL WITH SUBSEQUENT RADIATION SERVICE. EXPERIMENTAL RESULTS FROM THE REACTOR SURVEILLANCE PROGRAM DEVELOPED THROUGH ONE COMPLETE IRRADIATION AND ANNEALING CYCLE ARE PRESENTED, TOGETHER WITH A SUMMARY OF EXPERIMENTAL INFORMATION ON THE ANNEALING RESPONSE OF THE VESSEL STEEL (A350-LF1, MOD.) FROM ACCELERATED IRRADIATION PROGRAMS. THESE DATA INDICATE A 0 DEG F MAXIMUM PRESSURE VESSEL WALL CHARPY-V 30 FT-LB TRANSITION TEMPERATURE AFTER THE IN-PLACE ANNEAL VERSUS A -80 DEG F PRESERVICE TRANSITION TEMPERATURE (BASED ON THE NOTCH-DUCTILITY PROPERTIES OF A DUPLICATE RING FORGING). THE MAXIMUM CHARPY-V 30 FT-LB TRANSITION TEMPERATURE OF THE PRESSURE VESSEL BEFORE THE ANNEALING OPERATION WAS ESTIMATED AT 190 DEG F. A PROJECTION OF POSTANNEAL PRESSURE VESSEL LIFETIME IN TERMS OF NEUTRON FLUENCE >0.5 MEV WAS DERIVED FROM SPECTRA CALCULATIONS AND THE EXPERIMENTALLY PREDICTED REIRRADIATION RESPONSE OF THE PRESSURE VESSEL STEEL. THE MAXIMUM PERMISSIBLE VESSEL WALL FLUENCE IS ESTIMATED AT 5.5X10 TO THE 19TH POWER N/SQ CM > 0.5 MEV. THIS IS COMPARABLE TO 124.7 MEGAWATT YEARS OF REACTOR OPERATION. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-671 851 13/1
COMBUSTION ENGINEERING INC WINDSOR CONN KREISINGER DEVELOPMENT LAB

A RESEARCH STUDY ON INTERNAL CORROSION OF HIGH-PRESSURE BOILERS. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
MAY 68 50P GOLDSTEIN,P. ;BURTON,C. L.
;

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: PRESENTED AT ASME - EEI CORROSION SEMINAR, HARTFORD, CONN., 21-22 MAY 1968.

DESCRIPTORS: (*BOILERS, *CORROSION), HIGH-PRESSURE RESEARCH, WATER, IMPURITIES, TEST FACILITIES, TEST METHODS, PHOTOMICROGRAPHY, PH, NUCLEATE BOILING, CORROSION INHIBITION, CHEMICAL ANALYSIS, DEPOSITS, CONDUCTIVITY, FAILURE(MECHANICS), EMBRITTLEMENT, OXIDATION, HEAT TRANSFER (U)
IDENTIFIERS: *HIGH-PRESSURE BOILERS, GRAPHS(CHARTS), FLOW REGIMES, *DUCTILE GOUGING (U)

THE GOAL OF THIS STUDY WAS TO DETERMINE THE CAUSE AND PRACTICAL PREVENTIVE SOLUTION FOR THE TYPE OF INTERNAL CORROSION COMMONLY EXPERIENCED IN BOILERS OPERATING AT PRESSURES BETWEEN 800 AND 2600 PSIG. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-672 890 18/13 13/4 20/11
NAVAL RESEARCH LAB WASHINGTON D C

NOTCH DUCTILITY AND TENSILE PROPERTY EVALUATION OF THE PM-2A REACTOR PRESSURE VESSEL. (U)

DESCRIPTIVE NOTE: INTERIM REPT.,
JUN 68 23P SERPAN,CHARLES Z. , JR;
REPT. NO. NRL-6739
PROJ: RR-007-01-46-5409

UNCLASSIFIED REPORT

DESCRIPTORS: (*NUCLEAR REACTORS, PRESSURE VESSELS), (*PRESSURE VESSELS, MECHANICAL PROPERTIES), NOTCH SENSITIVITY, REACTOR OPERATION, TENSILE PROPERTIES, NEUTRONS, DOSIMETERS, LIGHT WATER REACTORS, RADIATION DAMAGE, EMBRITTLEMENT, THICKNESS, BRITTLENESS, NON-DESTRUCTIVE TESTING, TRANSITION TEMPERATURE, STEEL, DEFECTS(MATERIALS), FRACTURE(MECHANICS), PRESSURIZATION (U)
IDENTIFIERS: *FRACTURE TOUGHNESS (U)

FOLLOWING THE PRESSURIZATION-TO-FAILURE TESTING OF THE PM-2A REACTOR PRESSURE VESSEL, SEVERAL SECTIONS OF STEEL WERE REMOVED FROM THE VESSEL WALL IN A REGION ADJACENT TO THE ARTIFICIAL DEFECT. CHARPY V-NOTCH AND TENSION TEST SPECIMENS MACHINED FROM ONE OF THESE SECTIONS HAVE BEEN EVALUATED. THE IRRADIATED-CONDITION 30 FT-LB TRANSITION TEMPERATURES FOR THE 1/4-THICKNESS (NEAREST TO THE CORE) AND 3/4-THICKNESS LOCATIONS IN THE VESSEL WALL WERE +115F AND +55F, RESPECTIVELY, FOR MEASURED FISSION-SPECTRUM FLUENCES OF 7.3 AND 4.0 X 10 TO THE 18TH POWER N/SQ CM (GREATER THAN 1 MEV). THE 1/4-THICKNESS PROPERTIES AND FLUENCE MOST NEARLY REPRESENTED THOSE AT THE TIP OF THE ARTIFICIAL DEFECT. THE 0.2% YIELD STRENGTH FOR THE 1/4-THICKNESS LOCATION WAS 97,620 PSI AT -20F (FAILURE TEMPERATURE) AND 92,200 PSI AT +72F (TEMPERATURE AT TIME OF ACID-SHARPENING TREATMENT OF ARTIFICIAL DEFECT). SIGNIFICANT UNIFORM ELONGATION, REDUCTION OF AREA, AND ELONGATION PER 1 IN. WERE RETAINED BY THE STEEL. AN ASSESSMENT OF THE STRESS, TEMPERATURE, AND FLAW-SIZE CONDITIONS FOR THE PM-2A FAILURE, AS INDEXED BY THE IRRADIATED-CONDITION MECHANICAL PROPERTIES, INDICATES THAT THE FAILURE IS IN AGREEMENT WITH THE GENERALIZED FRACTURE ANALYSIS DIAGRAM. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-673 650 11/6 20/14 13/8
FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OHIO

THE STRAIN AGING OF OXYGEN IN MOLYBDENUM, (U)

SEP 67 1/P MA,YING-LIENG ;SUNG,TSU-YI ;

REPT. NO. FTD-HT-67-206

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: EDITED TRANS. OF CHIN SHU HSUEH PAO (CHINESE PEOPLE'S REPUBLIC) V8 N3 P332-338 1965.

DESCRIPTORS: (*STRAIN HARDENING, MOLYBDENUM), (*MOLYBDENUM, *STRAIN HARDENING), OXYGEN, EMBRITTLEMENT, AGE HARDENING, DISLOCATIONS, CRYSTALLOGRAPHY, CRYSTAL LATTICE DEFECTS, CHINA (U)
IDENTIFIERS: TRANSLATIONS (U)

THE REPORT DISCUSSES INVESTIGATIONS WHICH HAVE BEEN CARRIED OUT TO STUDY THE PROCESS OF STRAIN AGEING CAUSED BY OXYGEN IN MOLYBDENUM BY MEASURING THE VARIATION OF THE HEIGHT OF THE INTERNAL FRICTION PEAK WITH AGEING TIME. IT WAS FOUND THAT THE PEAK HEIGHT DECREASES GRADUALLY AND EVENTU DISAPPEARS WITH AGEING-TIME BOTH IN QUENCH-AGED AND IN STRAIN-AGED SPECIMENS. SYSTEMATIC STUDIES HAVE BEEN MADE ON THE KINETICS OF STRAIN AGEING AND ON THE EFFECT OF DEFORMATION ON THE PEAK HEIGHT. ACCORDING TO EXPERIMENTAL RESULTS, IT IS BELIEVED THAT THE DECREASE OF THE PEAK HEIGHT IS ASSOCIATED WITH THE SEGREGATION OF OXYGEN ATOMS TO DISLOCATIONS DURING AGEING. ON THE BASIS OF THE ASSUMPTION, THE DISLOCATION DENSITY AND THE ATMOSPHERE CONCENTRATION WERE ESTIMATED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-674 126 11/6 13/8
FRANKFORD ARSENAL PHILADELPHIA PA

EFFECT OF COLD WORK UPON THE EMBRITTLEMENT OF 70:30 ALPHA-BRASS IN 2% NA AMALGAM, (U)

MAR 68 12P RINNOVATORE,J. V. ;CORRIE, J. D. ;MEAKIN,J. D. ;

REPT. NO. FA-A68-4
PROJ: DA-1T014501B32A

UNCLASSIFIED REPORT
AVAILABILITY: PUB. IN TRANSACTIONS QUARTERLY, V61 N2 P321-329 JUN 68.
SUPPLEMENTARY NOTES: REVISION OF REPORT DATED 11 SEP 67.

DESCRIPTORS: (*BRASS, *EMBRITTLEMENT), (*COLD WORKING, EMBRITTLEMENT), LIQUID METALS, MERCURY ALLOYS, SODIUM ALLOYS, COPPER ALLOYS, ZINC ALLOYS, FRACTOGRAPHY, ELECTRON MICROSCOPY (U)

THE SUSCEPTIBILITY TO EMBRITTLEMENT OF COLD ROLLED 70:30 ALPHA BRASS IN THE PRESENCE OF A HG-2% NA AMALGAM HAS BEEN STUDIED. IT IS SHOWN THAT FOR SMALL AMOUNTS OF COLD WORK, THE ALLOY IS SEVERELY EMBRITTLED, AND THAT FAILURE OCCURS INTERGRANULARLY. AS THE AMOUNT OF COLD WORKING INCREASES, SUSCEPTIBILITY TO EMBRITTLEMENT DECREASES AND THE MODE OF FAILURE BECOMES TRANSGRANULAR. FOR EXTREMELY LARGE AMOUNTS OF COLD WORK, ESSENTIALLY NO EMBRITTLEMENT IS OBSERVED. IT IS CONSIDERED THAT THE ELIMINATION OF GRAIN BOUNDARIES, RESULTING FROM INCREASING COLD WORK, IS THE DOMINANT FACTOR RESPONSIBLE FOR THE OBSERVED CHANGES IN SUSCEPTIBILITY AND FRACTURE MODE. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1Z8ML1

AD-674 852 11/6 20/11
BROWN UNIV PROVIDENCE R I DIV OF ENGINEERING

PLASTIC DEFORMATION IN BRITTLE AND DUCTILE FRACTURE, (U)

JUL 68 56P DRUCKER,D. C. ;RICE,J. R. ;

CONTRACT: SD-86
MONITOR: ARPA E57

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: PRESENTED AT NATIONAL CONFERENCE ON FRACTURE MECHANICS, LEHIGH UNIV., BETHLEHEM, PA., JUN 67.

DESCRIPTORS: (*FRACTOGRAPHY, DEFORMATION), FRACTOGRAPHY, STEEL, ALUMINUM ALLOYS, CRACK PROPAGATION, STRAIN(MECHANICS), STRUCTURAL SHELLS, PLASTICITY, YIELD POINT, IRREVERSIBLE PROCESSES, EMBRITTLEMENT, TENSILE PROPERTIES, LOADING(MECHANICS), ELASTICITY, STRESSES, MATHEMATICAL ANALYSIS, DUCTILE BRITTLE TRANSITION, SYMPOSIA (U)

AN EFFORT IS MADE TO COVER THE FULL ELASTIC-PLASTIC RANGE FROM FRACTURES WHICH INITIATE AND PROPAGATE AT NOMINAL OR NET STRESS IN THE ELASTIC RANGE TO THE FRACTURES AT FULLY PLASTIC OR LIMIT LOAD CONDITIONS. SIMILARITIES AND DIFFERENCES OF BEHAVIOR BETWEEN STEELS WHICH ARE HIGHLY RATE-SENSITIVE AND ALUMINUM ALLOYS OR OTHER RATHER INSENSITIVE MATERIALS ARE EXAMINED. A DEMONSTRATION IS GIVEN OF THE LIKELIHOOD OF CONFUSING LIMIT LOAD FRACTURES WITH LOW STRESS FRACTURES. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-676 157 11/6 20/11
ILLINOIS INST OF TECH CHICAGO DEPT OF METALLURGICAL ENGINEERING.

THE EFFECT OF LEAD ON MICRO-CRACK INITIATION AND PROPAGATION IN ALLOY STEELS. PART A: EMBRITTLEMENT OF LEADED STEELS AT INTERMEDIATE TEMPERATURES. (U)

DESCRIPTIVE NOTE: FINAL TECHNICAL REPT. ON PHASE 1, JUL 68 194P MOSTOVY,SHELDON ;BREYER, NORMAN N. ;
REPT. NO. TR-10022-F
CONTRACT: DA-20-113-AMC-10820(T)

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO PART B, AD-676 158.

DESCRIPTORS: (*STEEL, EMBRITTLEMENT), (*LEAD, CRACK PROPAGATION), FAILURE(MECHANICS), FRACTOGRAPHY, CRACKS, FATIGUE(MECHANICS), IMPACT TESTS, TENSILE PROPERTIES, HIGH-TEMPERATURE RESEARCH, DUCTILITY (U)
IDENTIFIERS: STEEL 4145 (U)

A DETAILED INVESTIGATION WAS MADE OF THE INFLUENCE OF 0.30% LEAD ON THE ROOM AND ELEVATED TEMPERATURE MECHANICAL PROPERTIES OF A 4145 STEEL. LEADED AND NON-LEADED VERSIONS OF THIS IDENTICAL STEEL WERE QUENCHED AND TEMPERED TO ROOM TEMPERATURE STRENGTH LEVELS RANGING FROM 120 TO 240 KSI. THE PROPERTIES MEASURED INCLUDED BOTH COMPLETE TENSILE DATA AND IMPACT ENERGIES FOR ALL STRENGTH LEVELS. MACROFRACTOGRAPHS DETAILING DIFFERENCES IN FRACTURE MORPHOLOGY AT SPECIFIC TEST TEMPERATURES WERE ALSO INCLUDED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-676 315 18/10
NAVAL RESEARCH LAB WASHINGTON D C

IRRADIATION EFFECTS ON REACTOR STRUCTURAL MATERIALS. (U)

DESCRIPTIVE NOTE: QUARTERLY PROGRESS REPT., 1 MAY-31 JUL 68
AUG '68 37P STEELE,L. E. ;HAWTHORNE,J. R. ;SERPAN,C. Z. , JR.;POTAPOVS,ULDIS ; GRAY,R. A. , JR;
REPT. NO. NRL-MR-1908
PROJ: RRU07-01-46-5409

UNCLASSIFIED REPORT

DESCRIPTORS: (*REACTOR MATERIALS, RADIATION DAMAGE), PRESSURE VESSELS, THERMAL STABILITY, MARAGING STEELS, NOTCH SENSITIVITY, EMBRITTLEMENT, STEEL, RESPONSE, DUCTILITY, HEAT TREATMENT, NUCLEAR RADIATION, SENSITIVITY (U)
IDENTIFIERS: STEEL A-543, STEEL A-537, STEEL 5CR 3MO 12NI, STEEL A-302 (U)

THE RESEARCH PROGRAM OF THE NRL METALLURGY DIVISION, REACTOR MATERIALS BRANCH, IS DEVOTED TO THE DETERMINATION OF THE EFFECTS OF NUCLEAR RADIATION UPON THE PROPERTIES OF STRUCTURAL MATERIALS. THE OVERALL PROGRAM IS SPONSORED BY THE OFFICE OF NAVAL RESEARCH, THE U. S. ATOMIC ENERGY COMMISSION, AND THE ARMY NUCLEAR POWER PROGRAM. SINCE RESEARCH FINDINGS WHICH APPLY TO THE OBJECTIVES OF ONE SPONSORING AGENCY ARE ALSO OF INTEREST TO THE OTHERS, THE OVERALL PROGRAM PROGRESS IS REPORTED HEREIN. THIS REPORT, COVERING RESEARCH FOR THE PERIOD 1 MAY-31 JULY 1968, INCLUDES THE FOLLOWING: (1) IRRADIATION RESPONSE OF A 4-IN. A533-C, CLASS 2, SUBMERGED ARC WELDMENT, (2) RELATIVE SSOF IRRADIATION RESPONSE OF A HEAVY SECTION A533-B ELECTROSLAG WELDMENT, (3) SPECIAL A533-B STEEL HEAT FOR VARIABLE RADIATION EMBRITTLEMENT STUDIES, (4) THERMAL STABILITY EVALUATION OF NI-CR-MO WELD DEPOSITS, (5) THERMAL STABILITY EVALUATIONS OF 12NI-5CR-3MO MARAGING STEEL PLATE AT 550, 650, AND 740F, (6) LONG-TERM IRRADIATION OF PRESSURE VESSEL STEELS IN THE BIG ROCK POINT REACTOR, (7) PLATE DIRECTIONALITY CHARACTERISTICS OF IRRADIATED LACROSSE REACTOR PRESSURE VESSEL STEEL, AND (8) PRELIMINARY STUDY OF THE IRRADIATION RESPONSE. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1Z8ML1

AD-A80 602 18/10 11/6 13/5
NAVAL RESEARCH LAB WASHINGTON D C

THE EFFECT OF RESIDUAL ELEMENTS ON 550F IRRADIATION RESPONSE OF SELECTED PRESSURE VESSEL STEELS AND WELDMENTS. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
NOV 68 33P POTAPOVS,ULDIS ;HAWTHORNE,J. RUSSELL ;
REPT. NO. NRL-6803
PROJ: RR-007-01-46-5409

UNCLASSIFIED REPORT

DESCRIPTORS: (*STEEL, RADIATION DAMAGE), (*WELDS, RADIATION DAMAGE), (*RADIATION DAMAGE, *PRESSURE VESSELS), NUCLEAR REACTORS, EMBRITTLEMENT, NUCLEAR RADIATION, IMPURITIES, SENSITIVITY (U)
IDENTIFIERS: STEEL A-302-B, STEEL A-543 (U)

THE EFFECT OF VARIABLE RESIDUAL ELEMENT CONTENTS ON 550F RADIATION EMBRITTLEMENT SENSITIVITY OF PRESSURE VESSEL STEELS WAS EXAMINED. RESULTS INDICATE THAT PHOSPHORUS AND COPPER CAN CONTRIBUTE SIGNIFICANTLY TO THE 550F RADIATION EMBRITTLEMENT SENSITIVITY OF TYPE A302-B STEEL. THE RESULTS ALSO SHOW THAT VANADIUM MAY HAVE A SLIGHT ADVERSE EFFECT AND THAT SULFUR IS NEUTRAL, ALTHOUGH IT SERVES TO DECREASE THE FULL SHEAR ENERGY ABSORPTION LEVEL OF THE STEEL. NITROGEN VARIATIONS FROM APPROXIMATELY EQUAL TO 0.008% TO 0.015% IN ALUMINUM DEOXIDIZED STEEL HAVE NO SIGNIFICANT EFFECT, WHILE THE ADDITION OF ALUMINUM TO NI-CR-MO STEEL WITH A GIVEN NITROGEN CONTENT MAY SLIGHTLY PROMOTE IRRADIATION EMBRITTLEMENT. THE PROGRAM RESULTS DEMONSTRATE THAT APPARENT INSENSITIVITY TO 550F IRRADIATION EMBRITTLEMENT CAN BE CONSISTENTLY ACHIEVED WITH LABORATORY HEATS OF A NOMINAL A302-B STEEL COMPOSITION BY MAINTAINING THE TOTAL RESIDUAL ELEMENT CONTENTS AT A LOW LEVEL. RADIATION EMBRITTLEMENT SENSITIVITY OF WELDMENTS WAS INVESTIGATED IN A PROGRAM AIMED AT THE DEVELOPMENT OF LOW SENSITIVITY WELD FILLERS FOR JOINING NI-CR-MO STEEL. DATA FROM THIS NEW PROGRAM AGAIN POINT TO COPPER AS A DOMINATING FACTOR IN DETERMINING RADIATION EMBRITTLEMENT SENSITIVITY, FURTHER VERIFYING THE RESULTS OBTAINED IN THE NRL-USS A302-B STEEL INVESTIGATION. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-681 359 11/6
WASHINGTON UNIV SEATTLE COLL OF ENGINEERING

THE MICROSTRUCTURAL ASPECTS OF DEFORMATION AND FRACTURE AT ELEVATED TEMPERATURES. (U)

DESCRIPTIVE NOTE: FINAL REPT., 1 JUN 64-31 DEC 68,
DEC 68 14P TAGGART,R. ;POLONIS,D. H.
;
CONTRACT: NONR-477(40)
PROJ: NR-036-061

UNCLASSIFIED REPORT

DESCRIPTORS: (•COPPER ALLOYS, PHASE STUDIES), SOLID SOLUTIONS, DEFORMATION, MICROSTRUCTURE, GERMANIUM ALLOYS, SILICON ALLOYS, EMBRITTLEMENT, LIQUID METALS, MERCURY, ZINC, ALUMINUM, GALLIUM, CRACK PROPAGATION, CORROSION (U)
IDENTIFIERS: PHASE TRANSFORMATIONS (U)

A DEFORMATION HOT STAGE METALLOGRAPHIC FACILITY WAS DESIGNED, CONSTRUCTED AND OPERATED SUCCESSFULLY DURING THE INVESTIGATION OF SEVERAL SPECIFIC PROBLEM AREAS. THE TOPICS THAT WERE STUDIED INCLUDE VACANCY CONDENSATION PIT FORMATION ON ALUMINUM SURFACES, CRACK PROPAGATION IN ALUMINUM POLYCRYSTALS AND THE STRAIN INDUCED TRANSFORMATION OF METASTABLE ALLOY PHASES. SOME SELECTED EXPERIMENTS WERE CONDUCTED TO STUDY THE EFFECTS OF TEMPERATURE AND PRESSURE ON THE EMBRITTLEMENT OF ALUMINUM AND ZINC BY LIQUID METALS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-681 373 18/10 11/6 18/8
NAVAL RESEARCH LAB WASHINGTON D C

INITIAL ASSESSMENTS OF NOTCH DUCTILITY BEHAVIOR OF A533 PRESSURE VESSEL STEEL WITH NEUTRON IRRADIATION. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
NOV 68 23P HAWTHORNE,J. RUSSELL ;
POTAPOVS,ULDIS ;
REPT. NO. NRL-6712
PROJ: RR-007-01-46-5409

UNCLASSIFIED REPORT

DESCRIPTORS: (*STEEL, RADIATION DAMAGE), (*REACTOR MATERIALS, STEEL), DUCTILITY, EMBRITTLEMENT, WELDS, METAL PLATES, NEUTRONS, SENSITIVITY (U)
IDENTIFIERS: STEEL A 533-B, STEEL A 533-C (U)

EXPLORATORY ASSESSMENTS WERE MADE OF THE CHARPY-V NOTCH DUCTILITY CHARACTERISTICS OF HEAVY SECTION A533-B AND A533-C STEEL PLATE AND SUBMERGED ARC WELDMENTS FOLLOWING NEUTRON IRRADIATION AT 550F. THE EXPERIMENTAL EVALUATIONS WERE PERFORMED LARGELY WITH COMMERCIAL PRODUCTION MATERIALS AND INCLUDED COMPARISONS OF MATERIALS IN BOTH CLASS 1 AND CLASS 2 STRENGTH RANGES. POSTIRRADIATION NOTCH DUCTILITY PROPERTIES OF ONE 5-3/4-IN. A533-B CLASS 1 ELECTROSLAG WELDMENT WERE ALSO DEVELOPED. ASSESSMENTS MADE OF RELATIVE IRRADIATION PERFORMANCE WERE ASSISTED BY A COMPILATION OF RECENT INFORMATION ON THE RESPONSE OF THE ASTM REFERENCE A302-B STEEL PLATE. MAJOR RESEARCH FINDINGS INCLUDE THE OBSERVATION OF SIGNIFICANT VARIABILITY IN RADIATION EMBRITTLEMENT SENSITIVITY OF A533-B AND A533-C STEEL WHEREIN THE SENSITIVITY LEVEL OF PLATE AND WELD METAL IN SOME CASES EXCEEDED THAT OF THE ASTM REFERENCE PLATE. HIGH RADIATION EMBRITTLEMENT SENSITIVITY WAS NOTED FOR BOTH SUBMERGED ARC WELD DEPOSITS EXAMINED; HOWEVER, THE DATA SUGGEST THAT THE PERFORMANCE OF THE WELD-HEAT-AFFECTED ZONE PARALLELS THAT OF THE PARENT PLATE. HIGH EMBRITTLEMENT SENSITIVITY WAS ALSO NOTED FOR THE ELECTROSLAG WELD DEPOSIT, IN CONTRAST TO MARKEDLY LOW SENSITIVITY OF THE WELDMENT PARENT PLATE.

(U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 12BML1

AD-662 380 11/6 20/11
ILLINOIS UNIV URBANA DEPT OF THEORETICAL AND APPLIED MECHANICS

THE EMBRITTLING EFFECT OF SMALL ELASTIC STRESS WAVES ON CRACK TOUGHNESS OF A STRUCTURAL STEEL, (U)

67 29P SHOEMAKER,A. KENT ;
CONTRACT: DA-31-124-ARO(D)-66
MONITOR: AROD 3216;4-MC

UNCLASSIFIED REPORT
AVAILABILITY: PUB. IN JNL. OF MATERIALS, V2 N3 P597-624 SEP 67.
SUPPLEMENTARY NOTE: PRESENTED AT THE ANNUAL MEETING OF THE AMERICAN SOCIETY FOR TESTING AND MATERIALS (70TH), BOSTON, MASS., 25-30 JUN 67.

DESCRIPTORS: (•STEEL, MECHANICAL PROPERTIES), IMPACT TESTS, STRESSES, STRESS CORROSION, LOW-TEMPERATURE RESEARCH, FRACTOGRAPHY, EMBRITTLEMENT, NOTCH SENSITIVITY, FATIGUE(MECHANICS) (U)

THE REDUCTION IN STATIC LOW-TEMPERATURE CRACK TOUGHNESS, AS MEASURED BY FRACTURE MECHANICS WAS STUDIED IN AN A201B STRUCTURAL GRADE STEEL FOR THE EMBRITTLEMENT CAUSED BY SMALL-AMPLITUDE ELASTIC STRESS WAVES SUPERIMPOSED ON THE STATIC STRESS STATE OF AN EDGE-NOTCHED SPECIMEN. THE STRESS WAVES WERE GENERATED BY FIVE DIFFERENT METHODS OF IMPACTING THE EDGE OF THE SPECIMEN ON THE SIDE OPPOSITE THE CRACK TIP WHEN A STATIC LOAD EXISTED ON THE SPECIMEN. THE DATA SHOWED AN AVERAGE REDUCTION OF 26 PER CENT IN THE STATIC STRESSES OVER A TEMPERATURE RANGE OF -220 TO -190F FOR IMPACTING THE SPECIMEN WITH A STEEL BALL, A STEEL BAR, OR A BALL PEEN HAMMER. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-682 601 11/6
MARTIN MARIETTA CORP BALTIMORE MD RESEARCH INST FOR ADVANCED STUDIES

EFFECTS OF ALLOYING ON THE BRITTLE FRACTURE OF ZINC IN LIQUID MERCURY, (U)

MAR 68 12P KAMDAR,M. H. ;WESTWOOD,A. R. C. ;

CONTRACT: DA-31-124-ARO(D)-63
PROJ: DA-2-0-061102-B-32-D
MONITOR: AROD 3937:10-MC

UNCLASSIFIED REPORT
AVAILABILITY: PUB. IN ACTA METALLURGICA, V16 P1335-1342 1968.
SUPPLEMENTARY NOTE: REVISION OF REPT. DATED 2 JAN 68. SUPERSEDES REPT. DATED DEC 67, AD-668 661.

DESCRIPTORS: (*ZINC ALLOYS, BRITTLENESS), COPPER ALLOYS, GOLD ALLOYS, LIQUID METALS, MERCURY, FRACTURE(MECHANICS), STRESSES, EMBRITTLEMENT (U)

THE SUSCEPTIBILITY OF POLYCRYSTALLINE ZINC TO EMBRITTLEMENT BY LIQUID MERCURY IS MARKEDLY INCREASED BY ALLOYING WITH AS LITTLE AS 0.2 AT.% OF COPPER OR GOLD IN SOLID SOLUTION. TO DETERMINE THE CAUSE OF THIS PHENOMENON, A STUDY HAS BEEN MADE OF THE EFFECTS OF 0.05 OR 0.2 AT.% COPPER ON THE FLOW AND FRACTURE BEHAVIOR OF AMALGAMATED ZINC MONOCRYSTALS AND ASYMMETRIC BICRYSTALS. FRACTURE STRESS DATA FROM THESE EXPERIMENTS WERE USED IN CONJUNCTION WITH A CRITERION FOR CRACK INITIATION TO DETERMINE THE INFLUENCE OF ALLOYING ON CLEAVAGE SURFACE ENERGY, GAMMA. IT WAS FOUND THAT ALLOYING INCREASED THE CRITICAL RESOLVED SHEAR STRESS (C.R.S.S.) (TAU SUB C) OF AMALGAMATED BICRYSTALS BY A FACTOR OF TEN, AND THEIR FRACTURE STRESSES BY FACTORS OF 2-4, BUT THAT GAMMA WAS INCREASED ONLY FROM 45 PLUS OR MINUS 5 ERGS/SQ CM (PURE ZINC) TO 60 PLUS OR MINUS 7 ERGS/SQ CM. THE SIGNIFICANCE OF THIS AND OTHER OBSERVATIONS ARE DISCUSSED, AND IT IS CONCLUDED THAT THE INCREASED SUSCEPTIBILITY TO EMBRITTLEMENT BY LIQUID MERCURY OF POLYCRYSTALLINE ZINC ON ALLOYING IS NOT RELATED TO SOLUTE-INDUCED CHANGES IN MACROSCOPIC FLOW STRESS, STACKING FAULT ENERGY, SLIP MODE, OR STATE OF BONDING, BUT IN TAU SUB C. INCREASING TAU SUB C INHIBITS THE RELAXATION BY PLASTIC FLOW OF STRESS CONCENTRATIONS AT GRAIN BOUNDARIES, AND, IN THE PRESENCE OF MERCURY, FACILITATES CRACK INITIATION. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-682 603 11/6
MARTIN MARIETTA CORP BALTIMORE MD RESEARCH INST FOR ADVANCED STUDIES

EMBRITTLEMENT OF DILUTE ALLOYS OF ZINC BY LIQUID MERCURY, (U)

68 6P KAMDAR,M. H. ;WESTWOOD,A. R. C. ;

CONTRACT: DA-31-124-ARO(D)-63
PROJ: DA-2-0-061102B-32-0
MONITOR: AROD 3937:12-MC

UNCLASSIFIED REPORT
AVAILABILITY: PUB. IN TRANSACTIONS OF THE JAPAN INST. OF METALS, V9-SUPPL. P979-980 1968.
SUPPLEMENTARY NOTE: PRESENTED AT PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON THE STRENGTH OF METALS AND ALLOYS.

DESCRIPTORS: (•ZINC ALLOYS, •EMBRITTLEMENT), MERCURY, LIQUID METALS, COPPER ALLOYS, FRACTURE(MECHANICS), TENSILE PROPERTIES (U)

WHEN POLYCRYSTALLINE ZINC IS ALLOYED WITH 0.1-0.4 A/O COPPER, SILVER, OR GOLD, ITS SUSCEPTIBILITY TO EMBRITTLEMENT BY LIQUID MERCURY AT ROOM TEMPERATURE IS MARKEDLY INCREASED. IN ORDER TO CLARIFY SOME OF THE FACTORS INVOLVED, A STUDY HAS BEEN MADE OF THE TENSILE FLOW AND FRACTURE BEHAVIOR OF AMALGAMATED MONOCRYSTALS AND ASYMMETRIC BICRYSTALS OF ZINC CONTAINING 0.05 A/O AND 0.2 A/O COPPER IN SOLID SOLUTION. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-683 183 21/9.2 20/11
EXPLOSIVES RESEARCH AND DEVELOPMENT ESTABLISHMENT WALTHAM ABBEY (ENGLAND)

THE TENSILE PROPERTIES OF A POLYURETHANE PROPELLANT, UP 2, (U)

DEC 68 20P BRYANT,R. W. ;DUKES,W. A. ;

REPT. NO. ERDE-22/R/68

UNCLASSIFIED REPORT

DESCRIPTORS: (•SOLID ROCKET PROPELLANTS, TENSILE PROPERTIES), (•ISOCYANATE PLASTICS, TENSILE PROPERTIES), EMBRITTLEMENT, STRAIN(MECHANICS), BENDING, RUPTURE, STRESSES, GREAT BRITAIN (U)

A SAMPLE OF A POLYURETHANE PROPELLANT, DESIGNATED UP 2, HAS BEEN CHARACTERISED IN UNIAXIAL TENSION USING TIME-TEMPERATURE SUPERPOSITION PRINCIPLES, OVER WIDER RANGES OF STRAIN-RATE AND TEMPERATURE THAN HAVE BEEN USED PREVIOUSLY. NEAR THE EMBRITTLEMENT TEMPERATURE THE TRUE STRAIN (PHOTOGRAPHICALLY DETERMINED) RAPIDLY BECOMES MUCH LESS THAN THE NOMINAL STRAIN. CONSIDERATION OF NOMINAL STRAINS CAN THUS BE MISLEADING. UNDER THE CONDITIONS OF ROCKET IGNITION AT LOW TEMPERATURES THE TRUE STRAIN IS RAPIDLY DECREASING, AND THE TRUE MODULUS INCREASING, WITH DECREASING TEMPERATURE. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-686 183 11/6
RENSSELAER POLYTECHNIC INST TROY N Y

LIQUID METAL EMBRITTLEMENT, (U)

68 29P STOLOFF,N. S. ;
CONTRACT: DA-31-124-ARO(D)-468
PROJ: DA-2-0-061102-B-32-D
MONITOR: AROD 6339:2-MC

UNCLASSIFIED REPORT
AVAILABILITY: PUB. IN SURFACES AND INTERFACES, V2 P157-182 1968.

DESCRIPTORS: (*EMBRITTLEMENT, *LIQUID METALS), DUCTILE BRITTLE TRANSITION, LIQUID METALS, GRAIN BOUNDARIES, DIFFUSION, CRACK PROPAGATION, REVIEWS (U)

LIQUID METAL EMBRITTLEMENT SOMETIMES OCCURS BY DIFFUSION-CONTROLLED PROCESSES SUCH AS GRAIN BOUNDARY PENETRATION. THIS TYPE OF BEHAVIOR, WHICH ALWAYS LEADS TO INTERGRANULAR FAILURE, HAS BEEN TREATED THEORETICALLY BY GRAIN BOUNDARY WETTING CONCEPTS AND BY A STRESS-ENHANCED DISSOLUTION MODEL. DIFFUSION ALONG BOUNDARIES MAY ALSO PLAY A ROLE IN DELAYED FAILURE (STATIC FATIGUE) PHENOMENA, AS THERE IS EVIDENCE OF SURFACE NOTCHING DURING EXPOSURE OF SUSCEPTIBLE SOLIDS TO LIQUID METALS. REFRACTORY METALS ARE SUBJECT TO A CORROSION-TYPE ATTACK BY BOILING MERCURY AT TEMPERATURES GREATER THAN 600C; THIS REPRESENTS THE THIRD MAJOR CLASS OF LIQUID METAL EMBRITTLEMENT PHENOMENA. THE INTERRELATIONSHIP AMONG AND THE DISTINGUISHING FEATURES OF THE VARIOUS FORMS OF EMBRITTLEMENT WILL BE DISCUSSED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-686 398 21/4.2
EXPLOSIVES RESEARCH AND DEVELOPMENT ESTABLISHMENT WALTHAM ABBEY (ENGLAND)

MEASUREMENT OF EMBRITTLEMENT TEMPERATURES (BRITTLE POINTS) OF COMPOSITE PROPELLANTS BY THE BENDING BEAM METHOD. (U)

DESCRIPTIVE NOTE: TECHNICAL MEMO.,
OCT 68 18P BRYANT,R. W. ;DUKES,W. A. ;
REPT. NO. ERDE-15/M/68

UNCLASSIFIED REPORT

DESCRIPTORS: (*COMPOSITE PROPELLANTS, EMBRITTLEMENT), TRANSITION TEMPERATURE, IGNITION, STRAIN(MECHANICS), FRACTURE(MECHANICS), RUPTURE, BENDING, TENSILE PROPERTIES, ELASTICITY, PLASTICITY, DEFORMATION, TEST EQUIPMENT, STRAIN GAGES, ISOCYANATE PLASTICS, TEMPERATURE, GREAT BRITAIN, SOLID ROCKET PROPELLANT BINDERS, POLYETHYLENE PLASTICS, BUTADIENES (U)
IDENTIFIERS: *BENDING BEAM TE' ETHOD, POLYISOBUTYLENE, POLYBUTAD ... (U)

A BENDING-BEAM METHOD FOR MEASURING EMBRITTLEMENT TEMPERATURES HAS BEEN REINTRODUCED AND EVALUATED BY COMPARING THE RESULTS OBTAINED WITH IT USING THREE DIFFERENT KINDS OF COMPOSITE PROPELLANT (BASED ON POLYISOBUTYLENE, POLYURETHANE OR CARBOXY-TERMINATED POLYBUTADIENE BINDERS) WITH MASTER CURVES OF STRAIN-AT-RUPTURE AS A FUNCTION OF 'REDUCED' STRAIN-RATE (ITSELF A FUNCTION OF STRAIN-RATE AND OF TEMPERATURE) DERIVED INDEPENDENTLY. THREE DEGREES OF BENDING, IMPOSING STRAINS OF 5, 10 AND 25 PER CENT, WERE USED. GOOD AGREEMENT BETWEEN THE TWO GROUPS OF RESULTS WAS FOUND, AND IT IS CONCLUDED THAT THIS BENDING-BEAM METHOD IS IN PRINCIPLE SUITABLE AS A ROUTINE INSPECTION TEST. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-690 245 11/6 20/12
ARMY MATERIALS AND MECHANICS RESEARCH CENTER WATERTOWN MASS

FATIGUE-CRACK PROPAGATION IN 4340 STEEL AS AFFECTED BY TEMPERING TEMPERATURE. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
JUN 69 27P ANCTIL,ALBERT A. ;KULA, ERIC B. ;
REPT. NO. AMMRC-TR-69-15
PROJ: DA-1-T-062105-A-328

UNCLASSIFIED REPORT

DESCRIPTORS: (*STEEL, CRACK PROPAGATION), FATIGUE(MECHANICS), TEMPERING, MARTENSITE, FRACTURE(MECHANICS), TOUGHNESS, IMPACT TESTS, STRESSES, STRAIN(MECHANICS), EMBRITTLEMENT, LIFE EXPECTANCY, ETHANOLS (U)
IDENTIFIERS: STEEL 4340 (U)

THE FATIGUE-CRACK PROPAGATION BEHAVIOR OF HEAT-TREATED 4340 STEEL HAS BEEN STUDIED AS A FUNCTION OF TEMPERING TEMPERATURE FROM 400 TO 800 F AND AT + 80 AND -50 F TEST TEMPERATURES. FRACTURE MECHANICS ANALYSIS OF THE DATA WAS USED FOR THROUGH-THICKNESS CRACKS IN CENTER-NOTCHED SHEET SPECIMENS. SPECIAL EMPHASIS WAS PLACED ON THE PHENOMENON OF TEMPERED MARTENSITE EMBRITTLEMENT, WHICH OCCURS IN THE 500 TO 700 F RANGE OF TEMPERING TEMPERATURES, TO SEE IF IT CAN BE DETECTED BY FATIGUE TESTING. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-690 806 11/6
ARMY MATERIALS AND MECHANICS RESEARCH CENTER WATERTOWN MASS

THERMAL EMBRITTLEMENT OF STEEL FOR 175-MM GUN TUBES. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
JUN 69 20P CARR,FRANK L.; LARSON, FRANK R. ;
REPT. NO. AMMRC-TR-69-16
PROJ: DA-1-C-024401-A-110

UNCLASSIFIED REPORT

DESCRIPTORS: (*GUN BARRELS, *EMBRITTLEMENT), (*STEEL, HEAT TREATMENT), BRITTLENESS, TEMPERING, TOUGHNESS, FRACTURE(MECHANICS), IMPACT TESTS, HARDNESS (U)
IDENTIFIERS: TRANSITION TEMPERATURE, M-113 GUNS(175-MM), 175-MM GUN TUBES (U)

SECTIONS OF TWO 175-MM M113 GUN TUBES WERE UTILIZED TO STUDY THE DEVELOPMENT OF BOTH REVERSIBLE AND IRREVERSIBLE TEMPER BRITTLENESS IN 3 PERCENT NICKEL-CHROMIUM GUN STEEL. RELATIVE MATERIAL TOUGHNESS INDICATED BY THE 100 PERCENT FIBROUS TRANSITION TEMPERATURE WAS DETERMINED ON NUMEROUS GROUPS OF SPECIMENS TEMPERED BETWEEN 900 AND 1200 F FOR VARIOUS TIMES. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1428ML1

AD-692 072 18/8 11/6 18/10
NAVAL RESEARCH LAB WASHINGTON D C

DAMAGE-FUNCTION ANALYSIS OF NEUTRON-ENERGY AND SPECTRUM EFFECTS UPON THE RADIATION EMBRITTLEMENT OF STEELS. (U)

DESCRIPTIVE NOTE: INTERIM REPT.,
JUL 69 20P SERPAN,C. Z. , JR.;
MCELROY,W. N. ;
REPT. NO. NRL-6925
PROJ: NRL-M01-14, RR-007-11-41-5409

UNCLASSIFIED REPORT

DESCRIPTORS: (•STEEL, •RADIATION DAMAGE), REACTOR MATERIALS, PRESSURE VESSELS, EMBRITTLEMENT, NEUTRON FLUX, NEUTRONS (U)
IDENTIFIERS: STEEL A-302-B (U)

THE REPORT PRESENTS THE RESULTS OF A NEW, COMPREHENSIVE SET OF EXPERIMENTAL DATA CONFORMING TO THE IRRADIATION CONDITIONS OF THE DERIVED DAMAGE FUNCTION (MATERIAL, TEMPERATURE, AND FLUENCE). THE RESULTS OF THIS EXPERIMENT ARE DISCUSSED IN TERMS OF THEIR ESTABLISHING THE VALIDITY OF THE DAMAGE FUNCTION. AVERAGED VALUES OF THE DAMAGE FUNCTION ARE TABULATED FOR A TYPICAL REACTOR PHYSICS CALCULATION ENERGY GROUP STRUCTURE, AND THEIR APPLICATION TO TWO DIFFERENT SPECTRA IS DESCRIBED. FINALLY, THE DAMAGE-FUNCTION FLUENCES REQUIRED TO CAUSE A 200F DELTA-TT IN A302-B STEEL ARE PRESENTED FOR MANY DIFFERENT REACTOR LOCATIONS. FOR EACH OF THE SPECTRA INVOLVED, THE UPPER AND LOWER ENERGY LIMITS OF SIGNIFICANTLY DAMAGING NEUTRONS ARE GIVEN, AND SOME DETAIL IS ALSO PROVIDED REGARDING THE CONTRIBUTION OF SUBGROUPS WITHIN THE OVERALL ENERGY SPECTRUM. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-694 058 20/2 20/13
MARTIN MARIETTA CORP BALTIMORE MD RESEARCH INST FOR ADVANCED STUDIES

SURFACE AND ENVIRONMENT-SENSITIVE MECHANICAL BEHAVIOR. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
JUL 69 159P WESTWOOD,ALBERT R. C. ;
LATANISION,R. M. ;
REPT. NO. TR-12, RIAS-TR-69-9C
CONTRACT: NONR-4162(00)
PROJ: NR-036-055

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: PREPARED IN COOPERATION WITH NATIONAL BUREAU OF STANDARDS, WASHINGTON, D. C.

DESCRIPTORS: (*CRYSTAL STRUCTURE, SURFACE PROPERTIES), (*CRYSTALS, MECHANICAL PROPERTIES), INORGANIC COMPOUNDS, METALLIC CRYSTALS, CRYSTALLOGRAPHY, ENVIRONMENT, DEFORMATION, CRYSTAL LATTICE DEFECTS, ATOMIC PROPERTIES, ADSORPTION, EMBRITTLEMENT, FILMS, CHEMICAL CONTAMINATION, SOLVENT ACTION, DIFFUSION (U)
IDENTIFIERS: IONIC CRYSTALS, REBINDER EFFECT (U)

THE INFLUENCES OF SURFACE STRUCTURE AND ENVIRONMENT ON THE MECHANICAL BEHAVIOR OF CRYSTALLINE INORGANIC SOLIDS ARE REVIEWED AND POSSIBLE MECHANISMS DISCUSSED. IN PARTICULAR, THE VARIOUS ROLES OF SUCH FACTORS AS THE ATOMIC, ELECTRONIC, AND DEFECT STRUCTURES OF THE NEAR-SURFACE REGIONS, THE PRESENCE OF ADSORBED SURFACE-ACTIVE SPECIES, ALLOYED LAYERS, OXIDE FILMS, GASEOUS OR LIQUID ENVIRONMENTS, ETC. ARE CONSIDERED IN CONNECTION WITH THE ROSCOE, REBINDER, AND JOFFE EFFECTS, LIQUID-METAL EMBRITTLEMENT, COMPLEX-ION EMBRITTLEMENT, HYDROGEN EMBRITTLEMENT, AND OTHER PHENOMENA. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1Z8ML1

AD-695 371 18/10 18/8 11/6
NAVAL RESEARCH LAB WASHINGTON D C

IRRADIATION EFFECTS ON REACTOR STRUCTURAL MATERIALS. (U)

DESCRIPTIVE NOTE: QUARTERLY PROGRESS REPT. 1 MAY-31 JUL 69,
AUG 69 48P STEELE,L. E. ;SERPAN,C. Z. , JR.;GRAY,R. A. , JR.;WATSON,H. E. ; SMIDT,F. A. ;
REPT. NO. NRL-MR-2027
PROJ: NRL-M01-14, RR-007-01-41-5409

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SPONSORED BY U. S. ATOMIC ENERGY COMMISSION. SEE ALSO QUARTERLY REPT. DATED APR 69, AD-690 863.

DESCRIPTORS: (*REACTOR MATERIALS, STEEL), (*STEEL, *RADIATION DAMAGE), EMBRITTLEMENT, POWER REACTORS, PRESSURE VESSELS, WELDS, NEUTRON SPECTRUM, NEUTRON FLUX, FRACTURE(MECHANICS), FRACTOGRAPHY, CRACKS, ANNEALING, MICROSTRUCTURE (U)
IDENTIFIERS: STEEL A543, STEEL A350, STEEL A537, STEEL A533 (U)

THE REPORT, COVERING RESEARCH FOR THE PERIOD 1 MAY - 31 JULY 1969, INCLUDES THE FOLLOWING: (1) IRRADIATION RESPONSE OF A543 STEEL TO DIFFERENT THERMAL/FAST NEUTRON FLUXES, (2) MECHANICAL PROPERTY AND NEUTRON SPECTRUM ANALYSES OF THE BIG ROCK POINT REACTOR PRESSURE VESSEL, (3) CHARPY-V NOTCH CHARACTERISTICS OF IRRADIATED A350-LF2 AND A537-B WELDMENTS FOR PRESTRESSED CONCRETE LINER APPLICATIONS, (4) AN ANALYSIS OF FRACTURE SURFACE MICROSTRUCTURE OF RADIATION SENSITIVE STEELS BY SCANNING ELECTRON MICROSCOPY, (5) THE INITIAL ASSESSMENT OF 550F RADIATION EMBRITTLEMENT SENSITIVITY OF A SPECIAL A533-B CLASS 1 ELECTROSLAG WELDMENT, AND (6) MECHANICAL PROPERTIES ASSESSMENTS OF THICK SECTION PLATES FROM LOW RESIDUAL A533-B SPECIAL HEAT. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-696 057 18/10 11/6 20/11
NAVAL RESEARCH LAB WASHINGTON D C

BEHAVIOR OF MECHANICAL PROPERTIES IN NEUTRON IRRADIATED 12NI-5CR-3MO MARAGING STEEL PLATE AND COMPANION WELD METALS. (U)

DESCRIPTIVE NOTE: INTERIM REPT.,
OCT 69 20P GRAY,R. A. , JR.;
HAWTHORNE,J. R. ;
REPT. NO. NRL-6945
PROJ: RR-007-11-41-5409

UNCLASSIFIED REPORT

DESCRIPTORS: (*REACTOR MATERIALS, MARAGING STEELS), (*MARAGING STEELS, RADIATION DAMAGE), (*NEUTRON REACTIONS, MARAGING STEELS), WELDS, HEAT TREATMENT, NOTCH TOUGHNESS, MICROSTRUCTURE, AGING(MATERIALS), EMBRITTLEMENT, THERMAL STABILITY, DETERIORATION, TENSILE PROPERTIES, ELONGATION, REDUCTION OF AREA, YIELD POINT (U)
IDENTIFIERS: *NEUTRON IRRADIATION (U)

CHANGES OF CHARPY-V-NOTCH DUCTILITY AND TENSILE STRENGTH IN NEUTRON-IRRADIATED 12NI-5CR-3MO MARAGING STEEL HAVE BEEN EVALUATED FOLLOWING LOW (LESS THAN 250F) AND ELEVATED (550 TO 740F) TEMPERATURE EXPOSURE. THE STUDY WAS PERFORMED WITH SIX HEATS OF 1-IN.-THICK PLATE MATERIAL AGED AT 900F FOR 2 AND 20 HR TO NOMINAL YIELD STRENGTHS OF 160 AND 180 KSI, RESPECTIVELY. THE LONG-TERM THERMAL STABILITY OF BOTH HEAT-TREATMENT CONDITIONS WAS INVESTIGATED FOR THE CONDITIONS OF IRRADIATION. THE LESS THAN 250F AND 550F IRRADIATION PERFORMANCE OF MATCHING (15-5-3) AND MISMATCHING (17NI-2CO-3MO) TIG WELD DEPOSITS MARAGED TO 180 KSI YIELD STRENGTH WAS ALSO ASSESSED IN THIS STUDY. CHANGES IN THE GENERAL PROPERTIES OF THE 12-5-3 MARAGING STEEL PLATE AND COMPANION WELD METALS WERE FOUND TO BE RATHER SMALL WITH LESS THAN 250F EXPOSURES, INDICATING GOOD RESISTANCE TO NEUTRON-INDUCED EMBRITTLEMENT. HOWEVER, A MARKED DETERIORATION OF NOTCH-DUCTILITY PROPERTIES WITH LONG-TERM EXPOSURE AT ELEVATED TEMPERATURE WAS REVEALED AND TRACED TO A NONNUCLEAR THERMAL INSTABILITY. THE OBSERVED INSTABILITY IS BELIEVED TO BE A CONTINUATION OF AGING PROCESSES AT TEMPERATURES WELL BELOW THE INITIAL MARAGING TEMPERATURE.

(U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-696 519 11/6 20/11
FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OHIO

FATIGUE AND EMBRITTLEMENT OF METALLIC MATERIALS, (U)

SEP 69 303P IVANOVA,V. S. ;GUREVICH,S. E. ;KOPEV,I. M. ;KUDRYASHOV,V. G. ; STEPANOV,V. N. ;
REPT. NO. FTD-HT-23-258-69(JPRS)
PROJ: FTD-7230178

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: UNEDITED ROUGH DRAFT TRANS. OF MONO. USTALOST I KHRUPKOST METALLICHESKIKH MATERIALOV, MOSCOW, 1968 P1-215.

DESCRIPTORS: (*FATIGUE(MECHANICS), METALS), (*METALS, BRITTLENESS), (*EMBRITTLEMENT, TEST METHODS), FRACTURE(MECHANICS), CRACK PROPAGATION, EMBRITTLEMENT, STRESSES, STRESS CORROSION, LOADING(MECHANICS), DEFORMATION, DISLOCATIONS, USSR (U)
IDENTIFIERS: TRANSLATIONS (U)

THE SUBJECTS COVERED INCLUDE: METHODS OF DETERMINING METAL SUSCEPTIBILITY TO BRITTLE FRACTURE AND THE PATTERN OF CRACK PROPAGATION UNDER STATIC AND CYCLIC LOADS, THE EMBRITTLING EFFECT OF CYCLIC LOADS, THE INFLUENCE OF STRESS CONCENTRATORS AND FRETTING-CORROSION ON FATIGUE RESISTANCE, PROBLEMS OF DEVELOPING MATERIALS WITH HIGH RESISTANCE TO CRACK PROPAGATION, AND VARIOUS ASPECTS OF ELASTIC MATERIALS AND THEIR MECHANICAL PROPERTIES. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 14BML1

AD-697 820 11/6 20/11
MARTIN MARIETTA CORP BALTIMORE MD RESEARCH INST FOR ADVANCED STUDIES

THE CHEMICAL AND PHYSICAL ASPECTS OF LIQUID METAL EMBRITTLEMENT. (U)

DESCRIPTIVE NOTE: FINAL REPT. MAY 66-JUN 69,
AUG 69 52P PREECE,CAROLYN M. ;WESTWOOD, ALBERT R. C. ;
REPT. NO. RIAS-TR-69-4C
CONTRACT: DA-18-001-AMC-1109(X)

UNCLASSIFIED REPORT

DESCRIPTORS: (*EMBRITTLEMENT, *LIQUID METALS), (*METALS, FRACTURE(MECHANICS)), ALUMINUM, CADMIUM, SILVER, BRASS, SILVER ALLOYS, GOLD ALLOYS, BRITTLENESS, GRAIN SIZE, TRANSITION TEMPERATURE, PHASE STUDIES, ADSORPTION (U)

A STUDY WAS MADE OF THE INFLUENCE OF VARIOUS LIQUID METALS AND SOLUTIONS ON THE FRACTURE BEHAVIOR OF ALUMINUM, CADMIUM, SILVER, BRASS AND SILVER-GOLD ALLOYS. THE PRINCIPAL EXPERIMENTAL VARIABLES WERE COMPOSITION AND GRAIN SIZE OF THE SOLID, COMPOSITION OF THE LIQUID METAL PHASE, TEMPERATURE AND RATE OF LOADING. THE RESULTS INDICATE THAT, BY USING APPROPRIATE VALUES OF THESE VARIABLES, IT IS POSSIBLE TO CONTROL (EITHER ENHANCE OR INHIBIT) EMBRITTLEMENT OVER FAIRLY WIDE RANGES. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-698 275 18/10 18/8 11/6
NAVAL RESEARCH LAB WASHINGTON D C

IRRADIATION EFFECTS ON REACTOR STRUCTURAL MATERIALS. (U)

DESCRIPTIVE NOTE: QUARTERLY PROGRESS REPT. 1 AUG-31 OCT 69,
NOV 69 27P STEELE,L. E. ;HAWTHORNE,J. R. ;WATSON,H. E. ;SERPAN,C. Z. , JR.; GRAY,R. A. , JR;
REPT. NO. NRL-MR-2056
PROJ: RR-007-01-41-5409

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO AD-695 371.

DESCRIPTORS: (*REACTOR MATERIALS, STEEL), (*STEEL, *RADIATION DAMAGE), PRESSURE VESSELS, FRACTURE(MECHANICS), EMBRITTLEMENT, ANNEALING, THERMAL STABILITY, STAINLESS STEEL, DUCTILITY, SENSITIVITY (U)

THE REPORT INCLUDES: (1) INITIAL COMPARISONS BETWEEN DYNAMIC TEAR TEST AND CHARPY V-NOTCH IMPACT DATA FOR IRRADIATED STEELS, INCLUDING THE PM-2A VESSEL STEEL, (2) THE RECOVERY OF DUCTILITY BY ANNEALING HEAT TREATMENT OF STEELS IRRADIATED TO DIFFERENT RATIOS OF THERMAL TO FAST NEUTRONS, (3) THE UNIRRADIATED PROPERTIES OF SPECIAL A533-B STEEL HEAT PROCURED FOR LOW EMBRITTLEMENT SENSITIVITY, (4) DATA DESCRIBING THE THERMAL STABILITY OF A POTENTIAL ADVANCED REACTOR STRUCTURAL ALLOY, 5NI-CR-MO-V STEEL, AND (5) INITIAL STRENGTH AND DUCTILITY DATA ON SELECTED AUSTENITIC STAINLESS STEELS, 304, 304L, 316, AND 316L, AFTER IRRADIATION IN THE EBR-II REACTOR TO FLUENCES BETWEEN 0.4 AND 9.0 X 10 TO THE 20TH POWER N/SQ CM > 1 MEV AT TEMPERATURES RANGING FROM 700F (371C) TO 830F (443C). (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-698 474 20/11
COLUMBIA UNIV NEW YORK HENRY KRUMB SCHOOL OF MINES

FUNDAMENTAL STUDIES OF FRACTURE. (U)

DESCRIPTIVE NOTE: FINAL REPT. 7 MAY 65-6 MAY 69,
DEC 69 10P GENSAMER,MAXWELL ;LI,JAMES
C. M. ;
CONTRACT: DA-31-124-ARO(D)-382
PROJ: DA-2-0-061102-B-32-D
MONITOR: AROD 5642:4-MC

UNCLASSIFIED REPORT

DESCRIPTORS: (*FRACTURE(MECHANICS),
*STRAIN(MECHANICS)), BRITTLENESS, DEFORMATION,
STRAIN HARDENING, EMBRITTLEMENT, STRESSES,
DISLOCATIONS, FATIGUE(MECHANICS), IRON ALLOYS,
SILICON ALLOYS, CRACK PROPAGATION, BRASS (U)

THE INVESTINGATION OF FRACTURE FOCUSED ON
ELUCIDATING THE MECHANISMS BY WHICH STRAIN BECOMES SO
CONCENTRATED THAT THE WORK OF DEFORMATION, LIMITED TO
A SMALL VOLUME BECOMES LITTLE. THE RESEARCH
CONCERNED PRIMARILY WITH ENGINEERING MATERIALS
CONSISTED OF THE FOLLOWING PHASES: (1) A
THEORETICAL STUDY OF THE ELASTIC CONTRIBUTION TO THE
SURFACE ENERGY CONTROLLING FINAL SEPARATION OF THE
MATERIAL EMBRITTLED BY PLASTIC DEFORMATION. (2)
AN EXPERIMENTAL STUDY OF HOW TO REVEAL THE PLASTIC
ZONE AND MEASURE ITS SIZE IN MATERIALS OF INTEREST.
(3) A STUDY OF STRAIN HARDENING, WHICH CONTROLS
THE PLASTIC ZONE SIZE, BY STUDYING THE EFFECTS OF
PRIOR STRAIN ON THE OPERATION OF LATENT SLIP SYSTEMS.
(4) A STUDY OF STRAIN HARDENING BY CALCULATING
THE STRESS AT A POINT DUE TO PILE-UP COMPLETE
DISLOCATION LOOPS. (5) A STUDY OF THE PROCESS
OF FRACTURE IN FATIGUE, BOTH EXPERIMENTAL BY OPTICAL
AND ELECTRON MICROSCOPY, AND THEORETICAL BY APPLYING
DISLOCATION DYNAMICS. (6) AN EXPERIMENTAL AND
THEORETICAL STUDY OF PLASTIC ZONE STRAIN
DISTRIBUTION, CONTROLLING FRACTURE TOUGHNESS, AND
PROPAGATION VELOCITY CONTROLLING CRACK SPEED, IN IRON
AND AN IRON-SILICON ALLOY. (7) A SIMILAR STUDY
OF BRASS, INVOLVING STACKING-FAULT ENERGY AS A
VARIABLE. (8) A STUDY OF CREEP, RELATING TO THE
SLOW GROWTH OF CRACKS PRECEEDING RAPID CRACK
PROPAGATION, BY APPLYING THE THEORY OF THERMALLY AND
STRESS ACTIVATED RATE PROCESSES TO DISLOCATION
MOVEMENTS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-700 233 11/4 18/8 18/10
NAVAL RESEARCH LAB WASHINGTON D C

TRENDS IN CHARPY-V SHELF ENERGY DEGRADATION AND YIELD STRENGTH INCREASE OF NEUTRON-EMBRITTLED PRESSURE VESSEL STEELS. (U)

DESCRIPTIVE NOTE: INTERIM REPT.,
DEC 69 29P HAWTHORNE,J. RUSSELL ;
REPT. NO. NRL-7011
PROJ: NRL-M01-14, RR-007-11-46-5409

UNCLASSIFIED REPORT

DESCRIPTORS: (•NUCLEAR REACTORS, MATERIALS), (•STEEL, •RADIATION DAMAGE), PRESSURE VESSELS, EMBRITTLEMENT, IMPACT TESTS, NEUTRON REACTIONS, TRANSITION TEMPERATURE, DUCTILITY, TOUGHNESS, TENSILE PROPERTIES, WELDS (U)
IDENTIFIERS: STEEL A-302-B, STEEL A-533, STEEL A-543 (U)

THE EFFECTS OF NEUTRON IRRADIATION ON CHARPY-V SHELF ENERGY AND YIELD STRENGTH WAS EXAMINED FOR THREE PRESSURE VESSEL STEEL COMPOSITIONS: A302-B, A533, AND A543. THE EFFECTS OF RADIATION EXPOSURE AT LOW TEMPERATURE (<300F (149C)) AND AT ELEVATED TEMPERATURE (550F (288 C) TO 740F (393C)) ON THE OVERALL NOTCH DUCTILITY ARE DOCUMENTED AND COMPARED. SUMMARY PLOTS SHOWING THE SIMULTANEOUS DEGRADATION IN SHELF ENERGY AND THE INCREASE OF YIELD STRENGTH LEVELS BROADLY ILLUSTRATE THE PROGRESSIVE CHANGE FROM DUCTILE FRACTURE PERFORMANCE TO RELATIVELY BRITTLE CHARACTERISTICS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-700 298 13/8
FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OHIO

METAL SOLDERING. (U)

SEP 69 441P LASHKO,V. F. ;LASHKO,S. V. ;

REPT. NO. FTD-MT-24-390-68
PROJ: FTD-723027B

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: EDITED MACHINE TRANS. OF MONO. PAIKA METALLOV, MOSCOW, 1967 PP-367.

DESCRIPTORS: (*SOLDERING, REVIEWS), SOLDERED JOINTS, SOLDERING ALLOYS, SOLDERING FLUXES, METAL PLATES, EMBRITTLEMENT, STRESSES, DIFFUSION BONDING, BONDING, BRAZING, METAL JOINTS, CRACKS, CRYSTALLIZATION, HEAT-RESISTANT MATERIALS, INTERACTIONS, USSR (U)
IDENTIFIERS: TRANSLATIONS (U)

THE BOOK INCLUDES MATERIAL ON NEW VARIETIES OF SOLDERING: DIFFUSION, RESISTANCE-REACTION; THE LATEST ACHIEVEMENTS IN THE REGION OF SOLDERING TECHNOLOGY OF ALLOYS BASED ON ALUMINUM, COPPER TITANIUM AND OTHERS ARE DESCRIBED. BASIC INFORMATION ON THE PHYSICAL CHEMISTRY FUNDAMENTALS OF PROCESSES OF SOLDERING ARE DISCUSSED, ESPECIALLY ON THE INTERACTION OF THE METAL TO BE SOLDERED WITH THE LIQUID SOLDER. PRACTICAL EXPERIENCE IS GENERALIZED IN THE APPRAISAL OF THE EFFECT OF COMPOSITIONS OF SOLDERS, SOLDERABLE METALS AND BASIC TECHNOLOGICAL FACTORS ON THE QUALITY OF SOLDERED JOINTS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-701 047 11/6
ILLINOIS INST OF TECH CHICAGO DEPT OF METALLURGICAL ENGINEERING

THE EFFECT OF LEAD ON MICRO-CRACK INITIATION AND PROPAGATION IN ALLOY STEELS. THE EFFECT OF COMPOSITION AND TEST CONDITIONS ON LEAD-EMBRITTLEMENT OF STEEL. (U)

DESCRIPTIVE NOTE: FINAL REPT. ON PHASE 2, NOV 69 149P WARKE, WILLIAM R. ; BREYER, NORMAN N. ;
CONTRACT: DA-20-113-AMC-10820(T)
MONITOR: TACOM TR-10752

UNCLASSIFIED REPORT

DESCRIPTORS: (*STEEL, EMBRITTLEMENT), (*EMBRITTLEMENT, *LEAD), LEAD ALLOYS, FRACTURE(MECHANICS), CRACK PROPAGATION, FATIGUE(MECHANICS), GRAIN SIZE, STRAIN(MECHANICS), CRACKS, TEMPERATURE, FRACTOGRAPHY (U)
IDENTIFIERS: STEEL 4145 (U)

THE EFFECTS OF COMPOSITION GRAIN SIZE, STRAIN RATE AND OTHER VARIABLES ON THE LEAD-EMBRITTLEMENT OF STEELS WERE STUDIED. THE LEAD EMBRITTLEMENT OF STEEL WAS OBSERVED AS A LOSS IN DUCTILITY AND TRUE FRACTURE STRENGTH OF HEAT TREATED STEEL TESTED AT ELEVATED TEMPERATURES IN THE PRESENCE OF LEAD. THE EMBRITTLEMENT WAS SEEN WHEN THE LEAD WAS PRESENT EITHER INTERNALLY IN THE STEEL (LEADED STEEL) OR SOLDERED TO THE SURFACE. THE PHENOMENON WAS FOUND TO EXIST OVER A RANGE OF TEMPERATURES FROM ABOUT 300F (I.E. MORE THAN 300 F BELOW THE MELTING POINT OF LEAD) TO A BRITTLE-TO-DUCTILE TRANSITION TEMPERATURE WHICH RANGED FROM 700 F TO OVER 900 F DEPENDING ON A NUMBER OF FACTORS B. IT WAS FOUND THAT THE EMBRITTLEMENT VARIED WITH COMPOSITION AND SEEMED, AT AN EQUIVALENT STRENGTH LEVEL, TO BE MORE SEVERE THE LOWER THE CARBON OR ALLOY CONTENT OF THE STEEL. THE LEAD CONTENT OF A LEADED STEEL WAS FOUND TO BE UNIMPORTANT, BUT THE COMPOSITION OF THE LEAD WAS CRITICAL. OTHER VARIABLES WHICH WERE STUDIED INCLUDED GRAIN SIZE, LOADING RATE, PRIOR PLASTIC STRAINING AT ROOM TEMPERATURE AND CYCLIC LOADING. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 14BML1

AD-706 004 18/10 11/6
NAVAL RESEARCH LAB WASHINGTON D C

POSTIRRADIATION CHARPY-V AND DYNAMIC TEAR SHELF LEVEL PERFORMANCE OF 12-IN. THICK A533-B PLATES AND WELD METAL. (U)

DESCRIPTIVE NOTE: MEMORANDUM REPT.,
APR 70 12P HAWTHORNE,J. R. ;
REPT. NO. NRL-MR-2114
PROJ: RR007-11-41-5409, NRL-M01-14

UNCLASSIFIED REPORT

DESCRIPTORS: (*REACTOR MATERIALS, STEEL), (*STEEL, RADIATION DAMAGE), METAL PLATES, WELDS, PRESSURE VESSELS, NEUTRON REACTIONS, EMBRITTLEMENT, DUCTILITY, IMPACT TESTS (U)
IDENTIFIERS: STEEL A-533B (U)

CHARPY-V (CV) AND DYNAMIC TEAR (DT) TEST COMPARISONS AT SHELF LEVEL TEMPERATURES WERE DEVELOPED FOR THE IRRADIATED CONDITION OF TWO 12-IN.-THICK A533-B STEEL PLATES AND A SUBMERGED ARC WELD DEPOSIT. MATERIALS FOR THIS INVESTIGATION WERE PROVIDED BY THE U. S. ATOMIC ENERGY COMMISSION'S HEAVY SECTION STEEL TECHNOLOGY (HSST) PROGRAM. INDIVIDUAL PLATES WERE IDENTIFIED AS HSST PLATES NOS. 01 AND 02; THE WELD PREPARED BY COMBUSTION ENGINEERING WAS IDENTIFIED AS WELD 50. LOW TEMPERATURE (<300F, 149C) AND ELEVATED TEMPERATURE (550F, 288C) IRRADIATIONS WERE CONDUCTED. FLUENCES FOR THE EIGHT IRRADIATION EXPERIMENTS RANGED FROM 2 TO 3 X 10 TO THE 19TH POWER N/SQ CM >1 MEV. EXPERIMENTAL RESULTS INDICATE THAT THE PERCENT REDUCTION IN C SUB V SHELF ENERGY IS COMPARABLE TO THE PERCENT REDUCTION IN DT SHELF ENERGY/C SUB V SHELF ENERGY RATIO FOR AN INDIVIDUAL MATERIAL ARE RETAINED UNDER IRRADIATION. OBSERVATIONS ARE IN AGREEMENT WITH RECENT FINDINGS FOR A543 AND OTHER A533 STEEL PLATES. RATIO RETENTION WOULD PERMIT THE DERIVATION OF AN APPROXIMATE POSTIRRADIATION DT SHELF ENERGY FROM POSTIRRADIATION C SUB V SHELF ENERGY FOR FRACTURE SAFETY ANALYSES. (AUTHOR) (U)

UDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 14BML1

AD-708 377 11/6 13/8
NAVAL RESEARCH LAB WASHINGTON D C

CORROSION FATIGUE CRACK GROWTH BEHAVIOR ABOVE AND BELOW K SUB ISCC. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
MAY 70 23P GALLAGHER,J. P. ;
REPT. NO. NRL-7064
PROJ: NRL-M01-08, RRU07-01-46-5416

UNCLASSIFIED REPORT

DESCRIPTORS: (*STEEL, *CRACK PROPAGATION), (*STRESS CORROSION, STEEL), FATIGUE(MECHANICS), FRACTURE(MECHANICS), HYDROGEN EMBRITTLEMENT (U)
IDENTIFIERS: STEEL HY-80, STEEL 4340 (U)

THE PURPOSE OF THIS INVESTIGATION WAS TO CONTRAST THE SALT WATER CORROSION FATIGUE CRACK PROPAGATION BEHAVIORS OBSERVED IN THE TWO REGIMES OF NO MEASURABLE SUSTAINED LOAD CRACK PROPAGATION AND OF MEASURABLE STRESS-CORROSION CRACKING RATES. A TYPICAL STRUCTURAL STEEL, HY-80 STEEL, HAVING INTERMEDIATE STRENGTH AND HIGH TOUGHNESS, WAS SELECTED FOR ITS HIGH RESISTANCE TO ENVIRONMENTAL CRACKING UNDER SUSTAINED LOAD. A HIGH-STRENGTH 4340 STEEL WHICH WAS PREVIOUSLY SHOWN TO BE HIGHLY SUSCEPTIBLE TO ENVIRONMENTAL CRACKING UNDER SUSTAINED LOADS WAS CHOSEN FOR THE STUDY. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-709 164 11/6
TRW EQUIPMENT LABS CLEVELAND OHIO MATERIALS TECHNOLOGY DEPT

EVALUATION OF HYDROGEN EMBRITTLEMENT MECHANISMS. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
JUL 70 25P BARTH,C. F. ;STEIGERWALD, E. A. ;
REPT. NO. ER-7477
CONTRACT: N00014-69-C-0286

UNCLASSIFIED REPORT

DESCRIPTORS: (*HYDROGEN EMBRITTLEMENT, THEORY), (*STEEL, HYDROGEN EMBRITTLEMENT), CRACK PROPAGATION, STRESSES, DIFFUSION (U)

THE INCUBATION TIME WHICH PRECEDES THE INITIATION OF SLOW CRACK GROWTH IN THE DELAYED FAILURE OF HIGH-STRENGTH STEEL CONTAINING HYDROGEN WAS REVERSIBLE WITH RESPECT TO THE APPLIED STRESS. THE KINETICS OF THE REVERSIBILITY PROCESS INDICATED THAT IT WAS CONTROLLED BY THE DIFFUSION OF HYDROGEN AND HAD AN ACTIVATION ENERGY OF APPROXIMATELY 9000 CAL/MOLE. REVERSIBLE HYDROGEN EMBRITTLEMENT STUDIES WERE ALSO CONDUCTED AT LIQUID NITROGEN TEMPERATURES WHERE DIFFUSIONAL PROCESSES SHOULD NOT OCCUR. THE PREVIOUSLY REPORTED LOW TEMPERATURE EMBRITTLEMENT BEHAVIOR WAS CONFIRMED INDICATING A BASIC INTERACTION BETWEEN HYDROGEN AND THE LATTICE. THE EXPERIMENTAL RESULTS COULD BE SATISFACTORILY EXPLAINED BY THE LATTICE EMBRITTLEMENT THEORY PROPOSED BY TROIANO. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 128ML1

AD-709 554 16/10
NAVAL RESEARCH LAB WASHINGTON D C

THE INFLUENCE OF COMPOSITION ON THE FRACTURE TOUGHNESS OF COMMERCIAL NUCLEAR VESSEL WELDS. (U)

DESCRIPTIVE NOTE: INTERIM REPT.,
JUN 70 22P STEELE,LENDELL E. ;
REPT. NO. NRL-7095
CONTRACT: AT(49-5)-2110
PROJ: RR007-11-41

UNCLASSIFIED REPORT

DESCRIPTORS: (*NUCLEAR POWER PLANTS, PRESSURE VESSELS), (*PRESSURE VESSELS, EMBRITTLEMENT), METAL JOINTS, WELDS, FRACTURE(MECHANICS), TOUGHNESS, RADIATION DAMAGE, STATISTICAL DATA (U)
IDENTIFIERS: FRACTURE MECHANICS, RADIATION EMBRITTLEMENT, STEEL A302-B, STEEL A533-B, ELECTROSLAG WELDING (U)

IRRADIATION STUDIES OF WELDS OF THE ASTM TYPE A302-B AND A533-B STEELS, MOST COMMONLY USED FOR COMMERCIAL WATER REACTOR VESSELS, DEMONSTRATED SEVERAL INSTANCES IN WHICH THE WELD METAL EXHIBITED LOWER FRACTURE TOUGHNESS OR GREATER ELEVATION OF THE BRITTLE-TO-DUCTILE TRANSITION TEMPERATURE THAN THAT OBSERVED FOR THE COMPANION BASE-PLATE AND WELD HEAT-AFFECTED-ZONE MATERIAL. EXAMINATION OF THE STRUCTURE AND COMPOSITION LED TO THE CONCLUSION THAT COMPOSITION IS CRITICAL TO THE LEVEL OF RADIATION-INDUCED EMBRITTLEMENT. THE LEVEL OF COPPER AND PHOSPHORUS CONTENTS HAS BEEN SHOWN TO BE ESPECIALLY CRITICAL TO THE LEVEL OF EMBRITTLEMENT WITH WELDS HAVING HIGH COPPER (>0.20%) AND PHOSPHORUS (> 0.015%) SHOWING GREATER EMBRITTLEMENT THAN THOSE CONTAINING LESSER AMOUNTS. THESE EXPERIMENTAL OBSERVATIONS WERE VERIFIED THROUGH LABORATORY TESTS IN WHICH THESE CONSTITUENTS AND OTHER RESIDUAL ELEMENTS WERE CONTROLLED IN WELDMENTS SIMULATING THOSE FOR REACTOR SERVICE. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-709 898 -79 11/6
NAVAL RESEARCH LAB WASHINGTON D C

ANALYSIS OF NEUTRON-EMBRITTLEMENT AND FLUX-DENSITY CONSIDERATIONS OF THE ARMY SM-1 REACTOR PRESSURE VESSEL, (U)

JUN 70 24P SERPAN,CHARLES Z. , JR;
REPT. NO. NRL-7101
PROJ: NRL-M01-14, USA-ERG-11-69

UNCLASSIFIED REPORT

DESCRIPTORS: (*PRESSURIZED WATER REACTORS, PRESSURE VESSELS), (*STEEL, EMBRITTLEMENT), NEUTRON FLUX, DOSIMETERS, NEUTRON SPECTRUM, TEMPERATURE, POWER REACTORS, STATISTICAL ANALYSIS, TRANSITION TEMPERATURE, REACTOR SYSTEM COMPONENTS (U)
IDENTIFIERS: FLUENCE, STEEL A-212, SM-1A REACTORS (U)

THE ARMY SM-1 REACTOR HAS BEEN EVALUATED WITH RESPECT TO THE INCREASE IN TRANSITION TEMPERATURE OF THE A212-B STEEL PRESSURE VESSEL. ALTHOUGH STEEL FROM THE HEAT FORMING THE VESSEL IS NOT AVAILABLE FOR IRRADIATION-RESPONSE BEHAVIOR TESTING, THE INITIAL TRANSITION TEMPERATURE OF 40 DEG F (4 DEG C) WAS DETERMINED FROM VESSEL STEEL. A RELATIONSHIP BETWEEN INCREASING EMBRITTLEMENT FOR A 4-IN.-THICK PLATE OF A212-B STEEL, REPRESENTING THE ASTM REFERENCE HEAT FOR THIS COMPOSITION, AND INCREASING NEUTRON FLUENCE WAS ESTABLISHED FOR THE IRRADIATION TEMPERATURE CONDITIONS OF THE SM-1 REACTOR. COMBINING WITH THIS THE ARMY-IMPOSED TRANSITION TEMPERATURE LIMIT FOR THE SM-1 REACTOR VESSEL OF 295 DEG F (146 DEG C) RESULTS IN A FLUENCE VALUE OF 2.65 X 10 TO THE 19TH POWER N/SQ.CM. > 0.5 MeV FOR A LIFETIME VESSEL EXPOSURE. THE NEUTRON FLUX LEVEL FOR THE VESSEL WAS ESTABLISHED BY EXTRAPOLATING A CORE-REGION FLUX MEASUREMENT USING THE RESULTS OF A CALCULATED NEUTRON SPECTRUM AT THE REACTOR VESSEL. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1Z8ML1

AD-711 321 18/10 11/6
NAVAL RESEARCH LAB WASHINGTON D C

IRRADIATION EFFECTS ON REACTOR STRUCTURAL MATERIALS. (U)

DESCRIPTIVE NOTE: QUARTERLY PROGRESS REPT. 1 MAY-31 JUL 70,
AUG 70 36P STEELE,L. W. ;HAWTHORNE,J. R. ;SERPAN,C. Z. , JR.;SMIDT,F. A. , JR.;
REPT. NO. NRL-MR-2153
CONTRACT: AT(49-5)-2110
PROJ: RR007-11-41-5409, NRL-M01-14

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO AD-707 536.

DESCRIPTORS: (*REACTOR MATERIALS, RADIATION DAMAGE); (*STEEL, RADIATION DAMAGE); (*VANADIUM, RADIATION DAMAGE); FRACTURE(MECHANICS), PRESSURE VESSELS, NEUTRON REACTIONS, EMBRITTLEMENT (U)
IDENTIFIERS: STEEL A-533B (U)

THE REPORT INCLUDES: (1) ASSESSMENTS OF RADIATION RESISTANT A533-B PLATE FROM A CONTROLLED COMPOSITION 30-TON DEMONSTRATION MELT, (2) A STUDY OF THROUGH-THICKNESS DUCTILITY IN AN IRRADIATED REACTOR VESSEL WALL, (3) NEUTRON EMBRITTLEMENT IN A SIMULATED REACTOR PRESSURE VESSEL WALL, AND (4) FUNDAMENTAL EXPLORATION OF RADIATION DAMAGE IN VANADIUM. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-714 166 11/6 18/8
NAVAL RESEARCH LAB WASHINGTON D C

DEMONSTRATION OF IMPROVED RADIATION EMBRITTLEMENT RESISTANCE OF A533-B STEEL THROUGH CONTROL OF SELECTED RESIDUAL ELEMENTS. (U)

DESCRIPTIVE NOTE: SUMMARY REPT.,
MAY 70 34P HAWTHORNE,J. RUSSELL ;
REPT. NO. NRL-7121
CONTRACT: AT(49-5)-2110
PROJ: RRU07-11-41-5409, NRL-M01-14

UNCLASSIFIED REPORT

DESCRIPTORS: (•STEEL, RADIATION DAMAGE), EMBRITTLEMENT, SENSITIVITY, PRESSURE VESSELS, REACTOR MATERIALS, DUCTILITY, TRANSITION TEMPERATURE, IMPURITIES, REDUCTION (U)
IDENTIFIERS: STEEL A-533B (U)

THE PRIMARY OBJECTIVE OF SPECIAL MELT SPECIFICATIONS AND MELT PLANNING WAS THE REDUCTION OF COPPER AND PHOSPHORUS CONTENTS TO THE LOWEST POSSIBLE LEVEL. RESTRICTIONS WERE ALSO IMPOSED ON THE CONTENT OF OTHER RESIDUAL IMPURITY ELEMENTS WITH KNOWN OR SUSPECTED INFLUENCES ON RADIATION EMBRITTLEMENT RESISTANCE. FOR A BROAD EXPERIMENTAL ANALYSIS, THE MELT WAS SPLIT TO PROVIDE MATERIAL REPRESENTING THE PRIMARY MELT ANALYSIS (0.038 CU) AND A MELT MODIFICATION (0.138 CU). PLATES REPRESENTING EACH ANALYSIS WERE ALSO SPLIT AND SECTIONS INDIVIDUALLY HEAT-TREATED TO CLASS 1 OR CLASS 2 STRENGTH CONDITIONS. ALL PROCEDURES USED WERE STANDARD MILL PRACTICES. RADIATION ASSESSMENTS SHOWED THE PRIMARY MELT ANALYSIS TO HAVE VERY LOW SENSITIVITY TO RADIATION EMBRITTLEMENT AT 550F (288C). (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-715 437 11/11
LOCKHEED-GEORGIA CO MARIETTA MATERIALS SCIENCES RESEARCH LAB

CLEANING AND CHEMICAL TREATMENT OF AIRCRAFT SURFACES TO PROVIDE OPTIMUM CLEANING PROPERTIES. (U)

DESCRIPTIVE NOTE: FINAL SUMMARY REPT. 23 OCT 67-23 OCT 70,
OCT 70 129P MILLER,R. N. ;HUMPHREY,F. T. ;BLEICH,A. ;
REPT. NO. LGR-ER-9703-8
CONTRACT: N00019-68-C-0017

UNCLASSIFIED REPORT

DESCRIPTORS: (*AIRCRAFT FINISHES, *CLEANING), QUALITY CONTROL, HYDROGEN EMBRITTLEMENT, RADIOACTIVE ISOTOPES, SURFACE PROPERTIES, COATINGS, ADHESION, EPOXY PLASTICS, PAINTS, CLEANING COMPOUNDS (U)
IDENTIFIERS: C-130 AIRCRAFT, P-3 AIRCRAFT, STRIPPABLE COATINGS (U)

FINAL RESULTS ARE PRESENTED OF A PROGRAM TO DEVELOP IMPROVED METHODS OF CLEANING AIRCRAFT SURFACES PRIOR TO PAINTING. THE FIRST OBJECTIVE OF THE PROGRAM WAS MET BY THE DEVELOPMENT OF A SIMPLE AND ACCURATE METHOD FOR DETERMINING THE DEGREE OF CLEANLINESS OF SURFACES. IT CONSISTS, ESSENTIALLY, OF PLACING 5-MICROLITER DROPS OF DISTILLED WATER ON THE TEST SURFACE, MEASURING THE DROP DIAMETER AND CONVERTING THE DROP DIAMETER TO A QUANTITATIVE VALUE OF SURFACE ENERGY. NINE CLEANING PROCEDURES WERE EVALUATED BY MEANS OF RADIOISOTOPE, SURFACE ENERGY, HYDROGEN EMBRITTLEMENT, AND COATING ADHESION TESTS. THE BEST TWO PROCEDURES WERE APPLIED TO A C-130 AT LOCKHEED-GEORGIA AND TO A P-3 AIRCRAFT AT LOCKHEED-CALIFORNIA BEFORE THE FINAL EPOXY-POLYAMIDE PAINT SYSTEM WAS APPLIED. FIVE HAND-PEELABLE AND FIVE ALKALINE-REMOVABLE COATINGS WERE EVALUATED FOR THEIR ABILITY TO PROTECT CLEAN SURFACES FROM CONTAMINATION. THE STRIPPABLE COATINGS WHICH GAVE THE BEST RESULTS IN LABORATORY TESTS WERE APPLIED TO P-3 FUSELAGE PANELS. HAND-STRIPPABLE COATING NO. 14 PROVIDED GOOD PROTECTION FOR THE PANELS DURING CHEMICAL CLEANING AND DURING DRILLING, COUNTERSINKING, AND RIVETING OPERATIONS. CHEMICALLY STRIPPABLE COATING NO. 11 PROVIDED GOOD PROTECTION FOR THE PANELS DURING THE DRILLING, (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1428ML1

AD-715 741 11/6
NORTHROP CORPORATE LABS HAWTHORNE CALIF

EMBRITTLEMENT BY LIQUID METALS. (U)

DESCRIPTIVE NOTE: FINAL REPT. 9 MAR-8 OCT 70,
NOV 70 oP KAMDAR,M. H. ;
REPT. NO. NCL-70-75R
CONTRACT: DAHC04-70-C-0028
MONITOR: AROD 9218:1-MC

UNCLASSIFIED REPORT

DESCRIPTORS: (•LIQUID METALS; •EMBRITTLEMENT), ZINC ALLOYS, CADMIUM ALLOYS, MERCURY, ALUMINUM ALLOYS (U)

THE REPORT GIVES A SUMMARY OF THE INVESTIGATIONS PERFORMED UNDER THE GENERAL TITLE, 'EMBRITTLEMENT BY LIQUID METALS.' DURING THE PERIOD OF THE REPORT, AN EARLIER INVESTIGATION OF THE EFFECTS OF SECOND PHASES ON THE SUSCEPTIBILITY OF ZINC-CADMIUM ALLOYS TO EMBRITTLEMENT BY LIQUID MERCURY AT AMBIENT TEMPERATURE WAS CONTINUED. THE INVESTIGATION WITH ZINC-CADMIUM ALLOYS WAS INTENDED TO ELUCIDATE THE ROLE OF PHASE IN INHIBITING THE EMBRITTLEMENT OF THE MATRIX PHASE (ZINC) IN MERCURY. IN OTHER STUDIES, POLYCRYSTALLINE ALUMINUM 2.5 W/O-ZINC 5.3 W/O-MAGNESIUM ALLOYS CONTAINING VARYING THICKNESSES (0.04 TO 0.35 MICRONS) OF DENUDED ZONES AT THE GRAIN BOUNDARY WERE TESTED IN TENSION TO FRACTURE IN LIQUID MERCURY AT 25C. IN ADDITION, STUDIES WERE UNDERTAKEN TO INVESTIGATE THE ROLE OF THE CHEMICAL NATURE OF THE LIQUID METAL OR LIQUID METAL SOLUTIONS IN DETERMINING THE OCCURRENCE AND THE SEVERITY OF LIQUID METAL EMBRITTLEMENT IN A GIVEN EMBRITTLEMENT COUPLE. THESE STUDIES REVEALED THAT THE SEVERITY OF LIQUID METAL EMBRITTLEMENT IS RELATED TO THE ELECTRONEGATIVITIES OF THE PARTICIPATING SOLID AND LIQUID METAL. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-715 807 11/6
PENNSYLVANIA UNIV PHILADELPHIA SCHOOL OF CHEMICAL ENGINEERING

FUNDAMENTAL CORROSION STUDIES: HYDROGEN EMBRITTLEMENT. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
DEC 70 38P NAMBOODHIRI,T. K. G. ;
NANIS,LEONARD ;
REPT. NO. UPH2-TR-002
CONTRACT: N00014-67-A-0216-0004
PROJ: NR-036-077

UNCLASSIFIED REPORT

DESCRIPTORS: (*HYDROGEN EMBRITTLEMENT, *IRON), DIFFUSION, COLD WORKING, ROLLING(METALLURGY), DEFORMATION (U)

THE ELECTROCHEMICAL PERMEATION METHOD WAS EXTENDED BY ANALYSIS OF THE DECAY TRANSIENT FOLLOWING STEADY STATE PERMEATION. FROM THE AMOUNT OF EXTRACTED HYDROGEN COMPARED WITH THE AMOUNT PREDICTED BY THE PERMEATION MODEL, IT IS POSTULATED THAT HYDROGEN DIFFUSIVITY IN ARMCO IRON IS CONCENTRATION DEPENDENT. PERMEATION STUDIES OF COLD-ROLLED ARMCO IRON INDICATE (A) DIFFUSIVITY D(2IC) DECREASES FROM, 5 X 10 TO THE -5TH TO 0.5 X 10 TO THE -5TH SQ CM/SEC. IN GOING FROM ANNEALED TO 28 REDUCED SAMPLES; (B) DEFORMATION RESULTS IN INCREASING ABSORPTION OF HYDROGEN FROM 1 X 10 TO THE -8TH TO 300 X 10 TO THE -8TH MOLE H/C.C. OF FE., IN GOING FROM ZERO TO 17.6% REDUCTION IN THICKNESS; (C) ADDITIONAL COLD WORK PRODUCES LITTLE FURTHER CHANGE IN HYDROGEN ABSORBED OR IN APPARENT DIFFUSIVITY. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-716 405 18/10 11/6
NAVAL RESEARCH LAB WASHINGTON D C

IRRADIATION EFFECTS ON REACTOR STRUCTURAL MATERIALS. (U)

DESCRIPTIVE NOTE: QUARTERLY PROGRESS REPT. 1 AUG-31 OCT 70,
NOV 70 61P STEELE,L. E. ;SERPAN,C. Z. , JR.;LOSS,F. J. ;HAWTHORNE,J. R. ; PUZAK,P. P. ;
REPT. NO. NRL-MR-2181
CONTRACT: AT(49-5)-2110
PROJ: RR007-11-41-5409, NRL-M01-14

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO QUARTERLY PROGRESS REPT. DATED 15 AUG 70, AD-711 321.

DESCRIPTORS: (*REACTOR MATERIALS, RADIATION DAMAGE), (*STEEL, RADIATION DAMAGE), (*VANADIUM, RADIATION DAMAGE), PRESSURE VESSELS, FRACTURE(MECHANICS), EMBRITTLEMENT, NEUTRON REACTIONS, DISLOCATIONS, ANNEALING (U)

THE REPORT, COVERING RESEARCH FOR THE PERIOD 1 AUGUST - 31 OCTOBER 1970, INCLUDES: (1) INITIAL RADIATION DAMAGE SURVEILLANCE RESULTS FOR THE MH-1A REACTOR VESSEL, (2) DEVELOPMENT OF A REFERENCE FLUENCE DECREASE THROUGH A REACTOR VESSEL WALL, (3) ANALYSIS OF THE FLUENCE GRADIENT IN TERMS IN TERMS OF FRACTURE BEHAVIOR, INCLUDING FRACTURE EXTENSION RESISTANCE FOR THE THROUGH-WALL VESSEL PROPERTIES, (4) CORRELATION OF CHARPY-V AND DYNAMIC TEAR TEST RESULTS FOR REACTOR STEELS AFTER IRRADIATION, (5) TRUE STRESS-NATURAL STRAIN DETERMINATIONS FOR SEVERAL HIGH TEMPERATURE ALLOYS IRRADIATED IN THE EBR-II REACTOR, AND (6) THE NATURE OF DISLOCATION LOOP GROWTH DURING ANNEALING OF IRRADIATED VANADIUM. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-717 460 13/5 18/10 11/6
NAVAL RESEARCH LAB WASHINGTON D C

RADIATION RESISTANT EXPERIMENTAL WELD METALS FOR ADVANCED REACTOR VESSEL STEELS, (U)

70 9P HAWTHORNE,J. R. ;FORTNER, E. ;GRANT,S. P. ;

UNCLASSIFIED REPORT
AVAILABILITY: PUB. IN WELDING JNL., 9P OCT 70.
SUPPLEMENTARY NOTE: PRESENTED AT THE AWS NATIONAL FALL MEETING HELD IN BALTIMORE, MD., ON 5-8 OCT 70.

DESCRIPTORS: (•WELDS, RADIATION DAMAGE), (•REACTOR MATERIALS, WELDS), (•STEEL, RADIATION DAMAGE), PRESSURE VESSELS, EMBRITTLEMENT, INHIBITION, WELDING RODS, CHEMICAL ANALYSIS, MECHANICAL PROPERTIES (U)

THE STUDY CLEARLY DEMONSTRATES EFFECTIVE CONTROL OVER THE RADIATION EMBRITTLEMENT BEHAVIOR OF A 2 1/4 CR-1MO WELD COMPOSITION. EXPERIMENTAL FINDINGS OPEN THE WAY FOR THE USE OF PROMISING HIGHER STRENGTH STEELS IN ADVANCED REACTOR VESSEL CONSTRUCTION. OPTIMUM RADIATION EMBRITTLEMENT RESISTANCE IS SHOWN TO REQUIRE COPPER CONTENTS APPRECIABLE LESS THAN 0.168. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. IZBML1

AD-717 553 11/6 19/6
WATERVLIET ARSENAL N Y

SUSCEPTIBILITY OF GUN STEELS TO STRESS CORROSION CRACKING. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
NOV 70 47P COLANGELO,VITO J. ;FERGUSON, MARTIN S. ;
REPT. NO. WVT-7012
PROJ: DA-66661

UNCLASSIFIED REPORT

DESCRIPTORS: (•STEEL, •STRESS CORROSION), (•GUN BARRELS, STRESS CORROSION), EMBRITTLEMENT, FRACTURE(MECHANICS), CRACK PROPAGATION (U)
IDENTIFIERS: HIGH STRENGTH STEELS (U)

PRECRACKED CANTILEVER BEAM SPECIMENS EXTRACTED FROM SPECIFIC GUN TUBES WERE SUBJECTED TO A CONSTANT LOAD IN VARIOUS ENVIRONMENTS TO DETERMINE FRACTURE TIMES. SPECIMENS EXHIBITED STRESS CORROSION SUSCEPTIBILITY IN 3% NACL, DISTILLED WATER AND 100% RH AIR, WITH 3% NACL BEING THE MOST DEGRADING ENVIRONMENT. VARIATIONS IN SUSCEPTIBILITY APPEARED ON A TUBE TO TUBE BASIS AND WERE RELATED TO THE TEMPER EMBRITTLED CONDITION OF THE TUBE. ADDITIONAL TESTS IN DISTILLED WATER, VARYING YIELD STRENGTH MATERIAL, SHOWED THAT FRACTURE TIME WAS DECREASED AND CRACK GROWTH RATES INCREASED AS THE YIELD STRENGTH WAS INCREASED. (AUTHOR) (U)

UDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-718 041 11/6
TRW EQUIPMENT GROUP CLEVELAND OHIO MATERIALS TECHNOLOGY LAB

EFFECT OF ALLOYING ELEMENTS ON TEMPERED MARTENSITE EMBRITTLEMENT AND FRACTURE TOUGHNESS OF LOW ALLOY HIGH STRENGTH STEELS. (U)

DESCRIPTIVE NOTE: FINAL REPT. 13 MAR 69-13 AUG 70,
JAN 71 82P VISHNEVSKY,C. ;
REPT. NO. ER-7384-1
CONTRACT: DAAG46-69-C-0060
PROJ: DA-1-T-062105-A-328
MONITOR: AMMRC CR-69-18/F

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO REPORT DATED FEB 70, AD-702 908.

DESCRIPTORS: (*STEEL, NOTCH TOUGHNESS), MARTENSITE, TENSILE PROPERTIES, FRACTURE(MECHANICS), EMBRITTLEMENT (U)
IDENTIFIERS: *HIGH STRENGTH STEELS (U)

A STUDY WAS PERFORMED ON THE INFLUENCE OF VARIOUS ELEMENTS ON THE NOTCH BEND FRACTURE TOUGHNESS AT 75F AND -100F OF .35%C, 3NI-CR-MO-V MARTENSITIC STEELS TEMPERED BETWEEN 400 AND 800F. THE ELEMENTS EXAMINED INCLUDED C, MN, SI, CR, NI, MO, CO, V AND AL. THE OVERALL VARIATION IN ROOM TEMPERATURE YIELD AND TENSILE STRENGTHS FOR TWENTY-FOUR STEELS WAS 155-230 KSI YIELD STRENGTH AND 188-288 KSI TENSILE STRENGTH. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-720 217 11/6 20/11
VIRGINIA POLYTECHNIC INST BLACKSBURG DEPT OF ENGINEERING MECHANICS

UTILIZATION OF HOLLOW NOTCHED ROUNDS IN FRACTURE TOUGHNESS EVALUATION, (U)

MAR 71 28P MCNITT,R. P. ;THOMPSON, W. F. ;SAWYER,S. O. ; III;
REPT. NO. VPI-E-71-2
CONTRACT: DAAF07-69-C-0444

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: PRESENTED AT THE SESA FALL MEETING, BOSTON, MASS. OCT 70.

DESCRIPTORS: (*METALS, *FRACTURE(MECHANICS)), HYDROGEN EMBRITTLEMENT, CRACK PROPAGATION, STEEL, ALUMINUM ALLOYS, NOTCH TOUGHNESS (U)
IDENTIFIERS: *FRACTURE TOUGHNESS, STEEL 4340, STEEL 4330, ALUMINUM ALLOY 7075-T651 (U)

RESULTS OF AN EXPERIMENTAL PROGRAM TO DETERMINE FRACTURE TOUGHNESS DATA UTILIZING SMALL NOTCHED ROUND TENSILE SPECIMENS ARE PRESENTED. HYDROGEN EMBRITTLEMENT WAS UTILIZED AS A CRACK STARTER FOR SEVERAL SOLID AISI 4340 STEEL SPECIMENS. THE FRACTURED AREAS WERE EXAMINED TO DIFFERENTIATE THE SLOW CRACK GROWTH DUE TO HYDROGEN AND THE FINAL RAPID CATASTROPHIC FRACTURE. HOLLOW NOTCHED ROUND SPECIMENS OF AISI 4340 STEEL, ALUMINUM 7075-T651 AND GUN STEEL 4330 WERE TESTED TO FAILURE FOR VARIOUS OUTSIDE DIAMETER, NOTCH ROOT RADIUS AND INTERNAL HOLE SIZE. THE RESULTING APPARENT FRACTURE TOUGHNESS VALUES ARE COMPARED TO KNOWN VALUES OBTAINED FROM PRECRACKED SPECIMENS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-720 676 18/10 11/6
NAVAL RESEARCH LAB WASHINGTON D C

ANALYSIS OF RADIATION-INDUCED EMBRITTLEMENT GRADIENTS ON FRACTURE CHARACTERISTICS OF THICK-WALLED PRESSURE VESSEL STEELS. (U)

DESCRIPTIVE NOTE: INTERIM REPT.,
MAR 71 23P LOSS,F. J. ;HAWTHORNE,J. R. ;SERPAN,C. Z. , JR.;PUZAK,P. P. ;
REPT. NO. NRL-7209
CONTRACT: AT(49-5)-2110
PROJ: RR007-11-41-5409, NRL-M01-14

UNCLASSIFIED REPORT

DESCRIPTORS: (*STEEL, RADIATION DAMAGE), (*REACTOR MATERIALS, EMBRITTLEMENT), FRACTURE(MECHANICS), PRESSURE VESSELS (U)
IDENTIFIERS: STEEL A-533B (U)

THE FRACTURE BEHAVIOR OF THICK-WALLED NUCLEAR VESSELS IS CONSIDERED FOR THE CASE OF A RADIATION-INDUCED TOUGHNESS GRADIENT THROUGH THE WALL WHICH CHARACTERISTICALLY RESULTS FROM NEUTRON ATTENUATION BY THE WALL MATERIAL ITSELF. FRACTURE-SAFE DESIGN ANALYSES BASED ON LINEAR ELASTIC FORMULATIONS OR EXTRAPOLATIONS OF THESE FORMULATIONS TO THE ELASTIC-PLASTIC REGIME ARE NOT SUFFICIENTLY DEVELOPED TO CHARACTERIZE THE INTEGRATED BEHAVIOR OF A WALL WHOSE TOUGHNESS CAN RANGE FROM BRITTLE AT THE INNER SURFACE TO HIGHLY DUCTILE AT THE OUTER SURFACE. SOLUTIONS TO THE PROBLEM IN THE FORESEEABLE FUTURE WILL BE OBTAINED ONLY BY EXPERIMENTAL MEANS. THE PRESENT APPROACH USES THE FRACTURE ANALYSIS DIAGRAM (FAD) TOGETHER WITH A NEW INTERPRETATIVE METHOD FOR FRACTURE EXTENSION RESISTANCE BASED ON MODIFIED DYNAMIC TEAR SPECIMENS AS THE TOOLS FOR GRADIENT ASSESSMENTS. WITH THESE TECHNIQUES THE SIGNIFICANCE OF THE TOUGHNESS GRADIENT THROUGH THE WALL IS ASSESSED IN TERMS OF THICK SECTION MECHANICAL CONSTRAINT, AND FRACTURE CHARACTERISTIC OF THE COMPLETE WALL ARE PREDICTED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. IZBML1

AD-720 678 16/10 11/6 13/8
NAVAL RESEARCH LAB WASHINGTON D C

MAJOR FACTORS AFFECTING NEUTRON IRRADIATION EMBRITTLEMENT OF PRESSURE-VESSEL STEELS AND WELDMENTS. (U)

DESCRIPTIVE NOTE: SUMMARY REPT.,
OCT 70 22P STEELE,LENDELL E. ;
REPT. NO. NRL-7176
CONTRACT: AT(49-5)-2110
PROJ: RR007-41-11-5409, NRL-M01-14

UNCLASSIFIED REPORT

DESCRIPTORS: (•STEEL, RADIATION DAMAGE), (•WELDS, RADIATION DAMAGE), REACTOR MATERIALS, EMBRITTLEMENT, PRESSURE VESSELS (U)
IDENTIFIERS: •NEUTRON IRRADIATION EMBRITTLEMENT (U)

THE MAJOR ASPECTS OF NEUTRON IRRADIATION EMBRITTLEMENT IN STEEL PRESSURE VESSELS OF LARGE COMMERCIAL NUCLEAR-POWER REACTORS ARE REVIEWED, DRAWING ON THE RESULTS OF AEC-SPONSORED PROGRAMS WHICH HAVE EMPHASIZED RESEARCH RELATED TO REACTOR VESSEL RELIABILITY. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 12BML1

AD-721 068 18/10 11/6
NAVAL RESEARCH LAB WASHINGTON D C

IRRADIATION EFFECTS ON REACTOR STRUCTURAL MATERIALS. (U)

DESCRIPTIVE NOTE: QUARTERLY PROGRESS REPT. 1 NOV 70-31 JAN 71,
FEB 71 34P STEELE,L. E. ;SERPAN,C. Z. , JR.;WATSON,H. E. ;HAWTHORNE,J. R. ; SMIDT,F. A. , JR;
REPT. NO. NRL-MR-2214
CONTRACT: AT(49-5)-2110
PROJ: RR007-11-41-5409, RR007-11-41-5425

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO QUARTERLY PROGRESS REPT. DATED 15 NOV 70, AD-716 405.

DESCRIPTORS: (*REACTOR MATERIALS, RADIATION DAMAGE), (*STEEL, RADIATION DAMAGE), (*VANADIUM, RADIATION DAMAGE), PRESSURE VESSELS, FRACTURE(MECHANICS), EMBRITTLEMENT, WELDS, NEUTRON REACTIONS, DISLOCATIONS, RECOVERY (U)

THE REPORT, COVERING RESEARCH FOR THE PERIOD 1 NOVEMBER 1970-31 JANUARY 1971, INCLUDES: (1) AN ANALYSIS OF THE COMPARATIVE RESULTS OF VARIOUS REACTOR PHYSICS CODES FOR PREDICTING THE NEUTRON SPECTRUM IN A SIMULATED PRESSURE VESSEL, (2) THE FRACTURE RESISTANCE OF IRRADIATED A533-B STEEL PLATE AND WELD METAL AS DEFINED BY SHELF LEVEL IN DYNAMIC NOTCHED IMPACT TESTS, AND (3) RESULTS SUGGESTING POSSIBLE MECHANISMS OF LOOP GROWTH DURING DAMAGE RECOVERY IN VANADIUM. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-723 224 11/6
CARNEGIE-MELLON UNIV PITTSBURGH PA METALS RESEARCH LAB

GRAIN BOUNDARY SEGREGATION OF IMPURITIES IN METALS AND INTERGRANULAR BRITTLE FRACTURE. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
MAY 71 41P LOW, JOHN R., JR.; SMITH, CRAIG L.;
REPT. NO. CMU-031-727-3
CONTRACT: N00014-67-A-0314-0002
PROJ: NR-031-727

UNCLASSIFIED REPORT

DESCRIPTORS: (•STEEL, •EMBRITTLEMENT), GRAIN BOUNDARIES, IMPURITIES, DUCTILE BRITTLE TRANSITION, TRANSITION TEMPERATURE, NEUTRON ACTIVATION (U)
IDENTIFIERS: STEEL 3340 (U)

TEMPER EMBRITTLEMENT IN LOW ALLOY STEELS WAS STUDIED BY EXAMINING CHANGES IN THE COMPOSITION OF PRIOR AUSTENITIC GRAIN BOUNDARIES RESULTING FROM EMBRITTLING TREATMENTS PERFORMED ON AN SB DOPED 3340 STEEL. NEUTRON ACTIVATION ANALYSIS WAS USED TO CHEMICALLY ANALYSE ETCHANT RESIDUES OBTAINED FROM INTERCRYSTALLINE FRACTURE SURFACES. ANTIMONY WAS SHOWN TO SEGREGATE TO THE GRAIN BOUNDARIES DURING EMBRITTLING WHILE THE CONCENTRATION OF NICKEL IN FERRITIC PORTIONS OF THE BOUNDARIES DECREASED. EMBRITTLEMENT TREATMENTS PRODUCED NO DETECTABLE CHANGES IN THE CHROMIUM CONTENT OF THE BOUNDARIES. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-725 945 11/6
NORTHROP CORPORATE LABS HAWTHORNE CALIF

THE OCCURRENCE OF LIQUID-METAL EMBRITTLEMENT. (U)

OCT 70 12P KAMDAR,M. H. ;
CONTRACT: DAHC04-70-C-0028
MONITOR: ARDO 9218:2-MC

UNCLASSIFIED REPORT
AVAILABILITY: PUB. IN PHYSICA STATUS SOLIDI (A) V4 N1 P225-233 1971.

DESCRIPTORS: (*CADMIUM, *EMBRITTLEMENT), (*MERCURY, EMBRITTLEMENT), FRACTURE(MECHANICS), LIQUID METALS, SOLUTIONS, MERCURY ALLOYS (U)
IDENTIFIERS: *LIQUID METAL EMBRITTLEMENT (U)

A STUDY HAS BEEN MADE OF THE FRACTURE BEHAVIOR OF CADMIUM IN LIQUID MERCURY AND SEVERAL LIQUID MERCURY SOLUTIONS. IT IS SHOWN THAT THE DEGREE OF EMBRITTLEMENT INDUCED IN A SOLID METAL CAN BE SIGNIFICANTLY AND PREDICTABLY AFFECTED BY INCORPORATING SELECTED EMBRITTLING ELEMENTS IN SOLUTION IN THE LIQUID-METAL ENVIRONMENT. FOR EXAMPLE, ADDITIONS OF MORE THAN 6 AT % OF INDIUM TO MERCURY AT ROOM TEMPERATURE CAUSED CADMIUM TO BEHAVE IN A BRITTLE MANNER IN THIS OTHERWISE 'INERT' ENVIRONMENT. FOLLOWING CONSIDERATION OF THE EXPERIMENTAL DATA FROM SUCH EXPERIMENTS, AND ALSO FROM THE PUBLISHED LITERATURE, IT IS SUGGESTED THAT A CORRELATION EXISTS BETWEEN THE OCCURRENCE AND SEVERITY OF LIQUID-METAL EMBRITTLEMENT AND THE ELECTRONEGATIVITIES OF THE PARTICIPATING SOLID AND LIQUID METALS. IT APPEARS THAT MAXIMUM EMBRITTLEMENT OCCURS WHEN THE SOLID METAL AND THE ACTIVE LIQUID METAL ARE OF SIMILAR ELECTRONEGATIVITY, AND THAT THE SEVERITY OF EMBRITTLEMENT DECREASES AS THE DIFFERENCE IN ELECTRONEGATIVITY BETWEEN THE TWO METALS INCREASES. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-726 099 13/8 11/6
AEROSPACE RESEARCH LABS WRIGHT-PATTERSON AFB OHIO

THE INFLUENCE OF THE THERMOMECHANICAL PROCESSING ON THE MECHANICAL PROPERTIES OF BETA III TITANIUM ALLOY. (U)

DESCRIPTIVE NOTE: FINAL REPT. 1 SEP 69-31 DEC 70, MAR 71 12P ROBERSON,JAMES A.; ADAIR, ATTWELL M.;
REPT. NO. ARL-71-0031
PROJ: AF-7021
TASK: 702100

UNCLASSIFIED REPORT

DESCRIPTORS: (*TITANIUM ALLOYS, *MECHANICAL WORKING), (*EXTRUSION, TITANIUM ALLOYS), MECHANICAL PROPERTIES, AGE HARDENING, HEAT TREATMENT, TENSILE PROPERTIES, EMBRITTLEMENT (U)
IDENTIFIERS: *METAL SWAGING, TITANIUM ALLOY BETA 3 (U)

THE EFFECTS OF EXTRUSION AND COLD SWAGING ON THE STRUCTURE AND PROPERTIES OF BETA III TITANIUM WERE INVESTIGATED; DIE LOADS FOR EXTRUSION WERE DETERMINED AT VARIOUS TEMPERATURES AND COMPARED TO DIE LOADS FOR OTHER ALLOYS; THE EFFECTS OF AGE HARDENING AFTER VARIOUS THERMAL AND MECHANICAL TREATMENTS WERE STUDIED. OPTIMUM TENSILE PROPERTIES WERE OBTAINED IN EXTRUDED AND AGED MATERIAL WHEN THE EXTRUSION TEMPERATURE WAS LOW AND THE COOLING RATE WAS HIGH. THE DIE LOADS DURING EXTRUSION COMPARED FAVORABLY WITH THOSE OF OTHER TITANIUM ALLOYS. COLD SWAGING PRIOR TO AGE HARDENING INCREASED HARDNESS AND TENSILE STRENGTH BUT CAUSED EMBRITTLEMENT WHEN THE AMOUNT OF DEFORMATION WAS SMALL. DUCTILITY WAS RESTORED BY LARGE AMOUNTS OF COLD SWAGING. FRACTURE TOUGHNESS WAS UNIVERSELY PROPORTIONAL TO ULTIMATE TENSILE STRENGTH. THESE OBSERVATIONS ARE EXPLAINED ON THE BASIS OF METALLOGRAPHY, ELECTRON MICROSCOPY, AND X-RAY DIFFRACTION. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1Z8ML1

AD-726 165 11/6 14/2
NAVAL AIR DEVELOPMENT CENTER WARMINSTER PA AERO MATERIALS DEPT

A COMPARISON OF VARIOUS TEST METHODS FOR DETECTING HYDROGEN EMBRITTLEMENT. (U)

DESCRIPTIVE NOTE: PROGRESS REPT.,
JUN 71 19P JANKOWSKY,E. J. ;
REPT. NO. NADC-MA-7066
PROJ: A320-5203/202-8/1F51-541-201

UNCLASSIFIED REPORT

DESCRIPTORS: (*HYDROGEN EMBRITTLEMENT, TEST METHODS), (*PAINT REMOVERS, HYDROGEN EMBRITTLEMENT), STEEL, STANDARDS (U)
IDENTIFIERS: EVALUATION (U)

FOUR HYDROGEN EMBRITTLEMENT TEST METHODS WERE EVALUATED USING THREE PAINT STRIPPERS AS THE EMBRITTLING MEDIA. RESULTS WERE COMPARED WITH THOSE OBTAINED WITH NOTCHED C-RINGS, THE METHOD NOW PRESCRIBED IN PAINT STRIPPER SPECIFICATIONS. IN GENERAL, ALL THE METHODS GIVE GOOD RESULTS AND GOOD CORRELATION. THE MAIN DIFFERENCES WERE IN EASE OF USE. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 128ML1

AD-726 308 11/6
MARTIN MARIETTA CORP BALTIMORE MD RESEARCH INST FOR ADVANCED STUDIES

CRACK INITIATION IN THE ZINC-MERCURY EMBRITTLEMENT COUPLE. (U)

70 [illegible] KAMDAR,M. H.

CONTRACT: DA-31-124-ARO(D)-63
PROJ: DA-2-0-061102-B-32-D
MONITOR: AROD 392,316-ML

UNCLASSIFIED REPORT
AVAILABILITY: PUB. IN CORROSION BY LIQUID METALS, P449-459 .70.
SUPPLEMENTARY NOTE: PREPARED IN COOPERATION WITH NORTHROP CORPORATE LABS., HAWTHORNE, CALIF.

DESCRIPTORS: (*ZINC), *CRACK PROPAGATION), (*EMBRITTLEMENT, ZINC), FRACTURE(MECHANICS), LIQUID METALS, MERCURY, CORROSION, NUCLEATION (U)
IDENTIFIERS: *LIQUID METAL EMBRITTLEMENT (U)

CLEAVAGE FRACTURE DATA FROM ZINC CRYSTALS TESTED IN TENSION IN LIQUID MERCURY ENVIRONMENT AT 298K AND IN AN INERT ENVIRONMENT AT 77K HAVE BEEN USED TO PROVIDE SUPPORT FOR THE VALIDITY OF A FRACTURE CRITERION AND TO DERIVE RELIABLE VALUES OF THE ENERGY TO INITIATE CLEAVAGE FRACTURE. THE RESULTS OBTAINED ARE CONSIDERED TO PROVIDE QUANTITATIVE SUPPORT FOR THE MECHANISM OF LIQUID METAL EMBRITTLEMENT IN WHICH ADSORPTION OF LIQUID METAL ATOMS REDUCES COHESION AT THE SITES OF HIGH STRESS CONCENTRATIONS ON THE SURFACE OF THE SOLID AND AT THE TIP OF THE PROPAGATING CRACK, FACILITATING THEREBY CRACK NUCLEATION AND CRACK PROPAGATION IN THE SOLID METAL. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1Z8ML

AD-727 038 21/9.2 20/11
EXPLOSIVES RESEARCH AND DEVELOPMENT ESTABLISHMENT WALTHAM ABBEY (ENGLAND)

COMPOSITE PROPELLANTS: STATISTICAL EVALUATION OF BRITTLE POINT (EMBRITTLEMENT TEMPERATURE) TESTS. (U)

DESCRIPTIVE NOTE: TECHNICAL NOTE,
NOV 70 15P BRYANT,R. W. ;
REPT. NO. ERDE-TN-22
MONITOR; TRC BR-23383

UNCLASSIFIED REPORT

DESCRIPTORS: (•TEST EQUIPMENT, RELIABILITY), (•COMPOSITE PROPELLANTS, EMBRITTLEMENT), DEFECTS(MATERIALS), CRACKS, TEMPERATURE, STRAIN(MECHANICS), TENSILE PROPERTIES, TEST METHODS (U)
IDENTIFIERS: EVALUATION, EMBRITTLEMENT TESTS, BENDING BEAM TESTS, PENDULUM TESTS (U)

EMBRITTLEMENT TEMPERATURES OF COMPOSITE PROPELLANTS, AT NOMINAL UNIAXIAL STRAINS OF 5, 10 AND 25 PER CENT, HAVE BEEN MEASURED BY TWO BENDING BEAM METHODS, AND THE RESULTS COMPARED STATISTICALLY WITH INTERPOLATIONS FROM WLF MASTER CURVES OF RUPTURE STRAIN IN TENSION AGAINST LOG REDUCED STRAIN-RATE. EFFECTIVE STRAINS ARE DEDUCED WHICH PLACE THE MAJORITY OF THE EMBRITTLEMENT TEMPERATURE VALUES WITHIN THE SCATTER OF THE WLF MASTER CURVES. IT IS CONCLUDED THAT THE RELATIVELY SIMPLE EMBRITTLEMENT TESTS YIELD MEASUREMENTS OF THE STRAIN AT RUPTURE NO MORE VARIABLE THAN THOSE DERIVED FROM A SIMILAR NUMBER OF UNIAXIAL TENSILE TESTS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-727 422 11/6 20/12
FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OHIO

BRITTLENESS OF STEEL, ITS CONNECTION WITH LOW-CYCLE FATIGUE, AND A CALCULATION PROVIDING WARNING OF BRITTLE FAILURE. (U)

FEB 71 10P BYKOV,V. A. ;NIKISHINA,M. L. ;

REPT. NO. FTD-HT-23-38-71
PROJ: AF-1368

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: EDITED TRANS. OF TERMOPROCHNOST MATERIALOV I KONSTRUKTIVNYKH ELEMENTOV SBORNIK (USSR) NS P197-200 1969, BY D. KVOLBECK.

DESCRIPTORS: (*STEEL, BRITTLENESS), FAILURE(MECHANICS), FATIGUE(MECHANICS), USSR (U)
IDENTIFIERS: TRANSLATIONS (U)

THE ARTICLE DEALS WITH BRITTLE FAILURE OF SHIP-HARD STEEL. IT IS CONCLUDED THAT LOW-CYCLE FATIGUE DAMAGE DOES NOT HAVE AN ESSENTIAL INFLUENCE ON THE RESISTANCE OF THE INVESTIGATED STEEL TO PLASTIC DEFORMATION, BUT DOES NOTICEABLY REDUCE RESISTANCE TO BRITTLE FAILURE. BRITTLE FAILURE IS PREDETERMINED BY AN UNFAVORABLE FORM OF THE STRESSED STATE AND ALSO BY OPERATING CONDITIONS WHICH HAVE A NEGATIVE INFLUENCE ON THE TOTALITY OF VALUES OF THE STEEL STRENGTH DURING BRITTLE FAILURE AND PLASTIC DEFORMATION. IN CALCULATIONS PROVIDING FOREWARNING OF BRITTLE FAILURE IT IS ADVISABLE TO COMPILE DIMENSIONLESS VALUES OF THE STRESS PARAMETER AND RHEOLOGICAL CHARACTERISTICS OF THE STEEL INDEPENDENTLY OF THE MAGNITUDE OF EXTERNAL FORCES. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-729 690U 11/6
ISRAEL ATOMIC ENERGY COMMISSION YAVNE SOREQ NUCLEAR RESEARCH CENTRE

HYDROGEN BEHAVIOR IN METALS USING NUCLEAR MAGNETIC RESONANCE. (U)

DESCRIPTIVE NOTE: FINAL SCIENTIFIC REPT. MAR 66-NOV 70,
NOV 70 166P ZAMIR,DAVID ;KORN,CHARLES ;
CONTRACT: AF 61(052)-904

UNCLASSIFIED REPORT

DESCRIPTORS: (*TITANIUM ALLOYS, HYDROGEN EMBRITTLEMENT), (*NUCLEAR MAGNETIC RESONANCE, *HYDROGEN EMBRITTLEMENT), PHASE STUDIES, RELAXATION TIME, HYDRIDES, ALUMINUM ALLOYS, X-RAY DIFFRACTION ANALYSIS, DIFFUSION, ISRAEL (U)
IDENTIFIERS: SPIN LATTICE RELAXATION, *TITANIUM HYDRIDES (U)

PARAMETERS CONSIDERED IMPORTANT FOR THE EXPLANATION OF HYDROGEN EMBRITTLEMENT OF TITANIUM AND ITS ALLOYS HAVE BEEN MEASURED USING NMR TECHNIQUES. THE PROTON SPIN LATTICE RELAXATION TIME T(1) HAS BEEN MEASURED BY THE PULSE TECHNIQUE AT 19.00 MHZ AS A FUNCTION OF TEMPERATURE IN THE RANGE 25-500C FOR A SERIES OF SAMPLES IN THE ALPHA, BETA, GAMMA PHASES OF TITANIUM HYDRIDE. THE DIFFUSIONAL ACTIVATION ENERGY WAS FOUND TO BE CONSTANT WITH RESPECT TO THE HYDROGEN CONCENTRATION. THE ACTIVATION ENERGY BEHAVIOR AND JUMP ATTEMPT FREQUENCY IS DISCUSSED IN RELATION TO A HARMONIC OSCILLATOR POTENTIAL WELL DERIVED FROM NEUTRON INELASTIC SCATTERING EXPERIMENTS AND FROM THIS STUDY. THE CONDUCTION ELECTRON CONTRIBUTION TO THE RELAXATION MECHANISM INCREASED WITH HYDROGEN CONCENTRATION, INDICATING AN INCREASE IN ENERGY DENSITY OF STATES AT THE FERMI LEVEL. HYDROGEN IN TITANIUM ALUMINUM ALLOYS WAS FOUND TO EXIST IN TWO DIFFERENT CRYSTALLOGRAPHIC ENVIRONMENTS, ONE DIFFUSING FASTER THAN THE OTHER. THE HYDRIDE SYSTEM IS PROBABLY BASED ON THE TI2AL STRUCTURE AND THE POSSIBLE LOCATION OF HYDROGEN IN THE LATTICE IS DISCUSSED. X-RAY MEASUREMENTS ON HYDROGEN FREE TI3AL AND TI3AL CONTAINING HYDROGEN GIVING AN H/TI RATIO OF 1.3, SHOWED EXTREME DISTORTION TO THE LATTICE UPON HYDROGEN ABSORPTION. THE X-RAY DIFFRACTION LINES FOR THE HYDRIDE COULD NOT BE RESOLVED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 12BML1

AD-730 435 18/10 11/6
NAVAL RESEARCH LAB WASHINGTON D C

IRRADIATION EFFECTS ON REACTOR STRUCTURAL MATERIALS. (U)

DESCRIPTIVE NOTE: QUARTERLY PROGRESS REPT. 1 MAY-31 JUL 71;
AUG 71 48P STEELE,L. E. ;LOSS,F. J. ;HAWTHORNE,J. R. ;WATSON,H. E. ;SHAHINIAN, P. ;
REPT. NO. NRL-MR-2338
CONTRACT: AT(49-5)-2110
PROJ: RRU22-11-41-5409, NRL-MD1-14

UNCLASSIFIED REPORT

DESCRIPTORS: (*REACTOR MATERIALS, RADIATION DAMAGE), (*STEEL, RADIATION DAMAGE), FRACTURE(MECHANICS), WELDS, PRESSURE VESSELS, EMBRITTLEMENT, LASERS, NEUTRON REACTIONS, FATIGUE(MECHANICS) (U)
IDENTIFIERS: STEEL A-533B (U)

THE RESEARCH PROGRAM INVOLVES A BROAD STUDY OF THE EFFECTS OF NUCLEAR RADIATION UPON MATERIALS. THE REPORT, COVERING RESEARCH FOR THE PERIOD, 1 MAY-31 JULY 1971, INCLUDES: (1) THE PLASTIC FRACTURE RESISTANCE OF THICK-SECTION A533-B STEEL, (2) A RADIATION RESISTANT WELD FOR FABRICATING A533-B REACTOR VESSELS, (3) THE EFFECTS OF IRRADIATION AND TEMPERATURE ON THE FATIGUE PROPERTIES OF A533-B STEEL, (4) THE VACANCY CONDENSATES PRODUCED BY LASER BOMBARDMENT, AND (5) THE LOW-ENERGY NEUTRON CONTRIBUTIONS TO EMBRITTLEMENT OF PRESSURE VESSEL STEEL. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY - SEARCH CONTROL NO. 1ZBML1

AD-730 439 16/10 11/6
NAVAL RESEARCH LAB WASHINGTON D C

RESIDUAL ELEMENTS AND IRRADIATION EMBRITTLEMENT. (U)

DESCRIPTIVE NOTE: INTERIM REPT.,
SEP 71 23P SMIDT,F. A. , JR.;STEELE, L. E. ;
REPT. NO. NRL-7310
CONTRACT: AT(49S)-2110
PROJ: RRUO/-11-41-5409, NRL-M01-14

UNCLASSIFIED REPORT

DESCRIPTORS: (•REACTOR MATERIALS, RADIATION DAMAGE), (•STEEL, RADIATION DAMAGE), PRESSURE VESSELS, EMBRITTLEMENT, IMPURITIES (U)

PAST WORK ON THE ROLE OF RESIDUAL ELEMENTS (PARTICULARLY COPPER AND PHOSPHORUS) IN THE ENHANCED IRRADIATION EMBRITTLEMENT OBSERVED IN PRESSURE-VESSEL STEELS IRRADIATED AT 550F (288C) IS REVIEWED. ONLY THREE MECHANISMS FOR EXPLAINING THE EMBRITTLEMENT ARE PLAUSIBLE--TEMPER EMBRITTLEMENT, IRRADIATION-ENHANCED DIFFUSION TO AN INTERFACE, AND ENHANCED NUCLEATION OF DEFECT AGGREGATES WHICH PRODUCE HARDENING AND EMBRITTLEMENT. EXPERIMENTS EMPLOYING SCANNING MICROSCOPY AND AUGER SPECTROSCOPY SHOW THAT THE EMBRITTLEMENT IS NOT PRODUCED BY SEGREGATION OF COPPER OR PHOSPHORUS AT AN INTERFACE. MICROHARDNESS RECOVERY EXPERIMENTS INDICATE THAT THE EMBRITTLEMENT IN COPPER-CONTAINING ALLOYS IS ACCOMPANIED BY GREATER IRRADIATION HARDENING. TRANSMISSION ELECTRON MICROGRAPHS OF SPECIAL IRON ALLOYS DOPED WITH 0.3 AT-% COPPER SHOW A MICROSTRUCTURE INDICATIVE OF A HIGHER CONCENTRATION OF DEFECT AGGREGATES THAN PURE IRON IRRADIATED UNDER THE SAME CONDITIONS. THESE AGGREGATES ARE BELIEVED TO BE VACANCY IN NATURE BECAUSE VACANCIES ARE MOBILE DURING IRRADIATION AT 550F (288C) AND BECAUSE NO CORRELATION BETWEEN EMBRITTLEMENT AND COPPER OR PHOSPHORUS CONTENT ARE NOTED AFTER IRRADIATION AT TEMPERATURES WHERE VACANCIES ARE NOT MOBILE. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 1ZBML1

AD-730 635 11/6
DEFENCE STANDARDS LABS MARIBYRNONG (AUSTRALIA)

EMBRITTLEMENT IN LOW-CARBON STEELS DUE TO MANGANESE. (U)

MAY 71 4P DE MORTON,M. E. ;

UNCLASSIFIED REPORT
AVAILABILITY: PUB. IN SCRIPTA METALLURGICA, V5 P659-662 1971. NO COPIES FURNISHED BY DDC OR NTIS.

DESCRIPTORS: (*STEEL, EMBRITTLEMENT), MANGANESE ALLOYS, CARBON ALLOYS (U)
IDENTIFIERS: CARBON STEELS (U)

THE ADDITION OF MANGANESE TO MILD STEEL INCREASES THE TOUGHNESS BY GRAIN REFINEMENT AND BY A CHANGE IN THE PEARLITE MORPHOLOGY FROM A LAMELLAR TO GRANULAR CARBIDE FORM. IN LOW-CARBON STEELS MANGANESE ADSORBS TO VARYING DEGREES AT THE CEMENTITE-AUSTENITE-FERRITE INTERFACES AND EFFECTIVELY INCREASES THE CEMENTITE-FERRITE INTERFACIAL ENERGY; THIS PREVENTS SPREADING OF THE CEMENTITE ALONG GRAIN BOUNDARIES AND THEREBY REDUCES THE TENDENCY FOR THE FORMATION OF DEGENERATE PEARLITE AND CARBIDE FILMS WHICH ARE KNOWN TO CRACK READILY DURING DEFORMATION AND INITIATE UNSTABLE FRACTURE IN THE MATRIX. THE PRESENT WORK SHOWS, HOWEVER, THAT THE RESULTING HIGHER PARTICLE-MATRIX INTERFACIAL ENERGY CAN PRODUCE ITS OWN PROBLEMS IN THAT CRACKING AT PARTICLE-MATRIX INTERFACES OCCURS MORE READILY DURING DEFORMATION AND CAN INDUCE EMBRITTLEMENT WHEN LARGE VOLUME FRACTIONS OF CARBIDE PHASE ARE PRESENT. (AUTHOR) (U)

CORPORATE AUTHOR - MONITORING AGENCY

*ADVANCED RESEARCH PROJECTS AGENCY ARLINGTON VA

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AD-674 852

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AMMRC-TR-69-15
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*ARMY MATERIALS RESEARCH AGENCY WATERTOWN MASS

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AMRA-TR-66-28
MECHANICAL PROPERTIES AND FRACTURE SURFACE TOPOGRAPHY OF A THERMALLY EMBRITTLED STEEL.
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*ARMY RESEARCH OFFICE DURHAM N C

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AROD-3216:4-MC
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AD-682 380

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AROD-3937:10-MC
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AD-682 601

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AROD-3937:12-MC
EMBRITTLEMENT OF DILUTE ALLOYS OF ZINC BY LIQUID MERCURY,
AD-682 603

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*BROWN UNIV PROVIDENCE R I DIV OF ENGINEERING

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*CARNEGIE-MELLON UNIV PITTSBURGH PA METALS RESEARCH LAB

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CMU-031-727-3
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*COLUMBIA UNIV NEW YORK HENRY KRUMB SCHOOL OF MINES

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FTD-HT-23-38-71
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EFFECT OF COLD WORK UPON THE EMBRITTLEMENT OF 70130 ALPHA-BRASS IN 2% NA AMALGAM,
AD-674 126

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MISSILE AND SPACE DIV

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THE EFFECT OF LEAD ON MICRO-CRACK INITIATION AND PROPAGATION IN ALLOY STEELS, THE EFFECT OF COMPOSITION AND TEST CONDITIONS ON LEAD-EMBRITTLEMENT OF STEEL,
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THE EMBRITTLING EFFECT OF SMALL ELASTIC STRESS WAVES ON CRACK TOUGHNESS OF A STRUCTURAL STEEL, (AROD-3216.-MC)
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T/AM-292
MECHANISMS OF ENVIRONMENT INDUCED SUBCRITICAL FLAW GROWTH IN AISI 4340 STEEL, (AROD-5612:1)
AD-639 666

•ISRAEL ATOMIC ENERGY COMMISSION YAVNE SOREQ NUCLEAR RESEARCH CENTRE

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HYDROGEN BEHAVIOR IN METALS USING NUCLEAR MAGNETIC RESONANCE,
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•LOCKHEED-GEORGIA CO MARIETTA MATERIALS SCIENCES RESEARCH LAB

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RIAS-TR-67-8C
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EFFECTS OF ALLOYING ON THE BRITTLE FRACTURE OF ZINC IN LIQUID MERCURY, (AROD-3937:10-MC)
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NADC-MA-7066
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UNCLASSIFIED

Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) DEFENSE DOCUMENTATION CENTER Cameron Station Alexandria, Virginia 22314	2a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED 2b. GROUP

3. REPORT TITLE

EMBRITTLEMENT

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)

Bibliography (March 1963 - September 1971)

5. AUTHOR(S) (First name, middle initial, last name)

6. REPORT DATE May 1972	7a. TOTAL NO. OF PAGES 142	7b. NO. OF REFS 100
8a. CONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S) DDC-TAS-72-21-I	
b. PROJECT NO.		
c.	9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report) AD-742 000	
d.		

10. DISTRIBUTION STATEMENT

Approved for public release; distribution unlimited.

11. SUPPLEMENTARY NOTES Supersedes AD-708 700	12. SPONSORING MILITARY ACTIVITY

13. ABSTRACT

References in this bibliography cover such topics as: embrittlement of metals by organic liquids, embrittlement of high-strength steel and aluminum in the presence of water, alcohols, glycols, ethers, and aldehydes, embrittlement of polycrystalline silver chloride, investigation of thermal embrittlement in managing steel, liquid metal embrittlement, stress-relief embrittlement of HY-130(T) weld metals and effect of embrittled 110-18 weld metal on the fatigue life of HY-80 steel butt weldments, etc.

Corporate Author-Monitoring Agency, Subject, Title, Contract, and Report Number Indexes are included.

DD FORM 1 NOV 68 1473

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14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
*Bibliographies						
*Embrittlement						
Steel Embrittlement						
Titanium Alloys						
Brass						
Metals						
Steel						
Radiation Damage						
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Pressure Vessels						
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